The FOUNDRY

Volume 51
Number 7

Published
Semimonthly

CLEVELAND, OHIO, APRIL 1, 1923

Accuracy Goal in Brass Shop

On Account of the Prominent Position in Which Many of the Castings Are Installed a Beautiful Exterior Surface Is as Necessary as a Solid and Homogeneous Interior

BY PAT DWYER

NATIVES of oriental countries are credited with the fatalism which holds that *what is to be, will be*. While sophisticated western people may profess to regard all far eastern belief as moonshine, there is no escaping the fact that the meteoric flight of a few captains of industry in each generation is noteworthy to a marked degree. Statistical bureaus of insurance companies and other somewhat similar organizations have collected figures from which any interested person may determine with reasonable accuracy, what percentage of babies born during a given year eventually will arrive at maturity; what portion will pass any specified age; what number will die in the poor house and what ratio will qualify for a niche in the hall of fame. What a wonderful upheaval would take place if some genius discovered a method for applying these figures so that an individual's destiny could be known in advance.

Generations of men succeed each other with the same inevitable regularity as

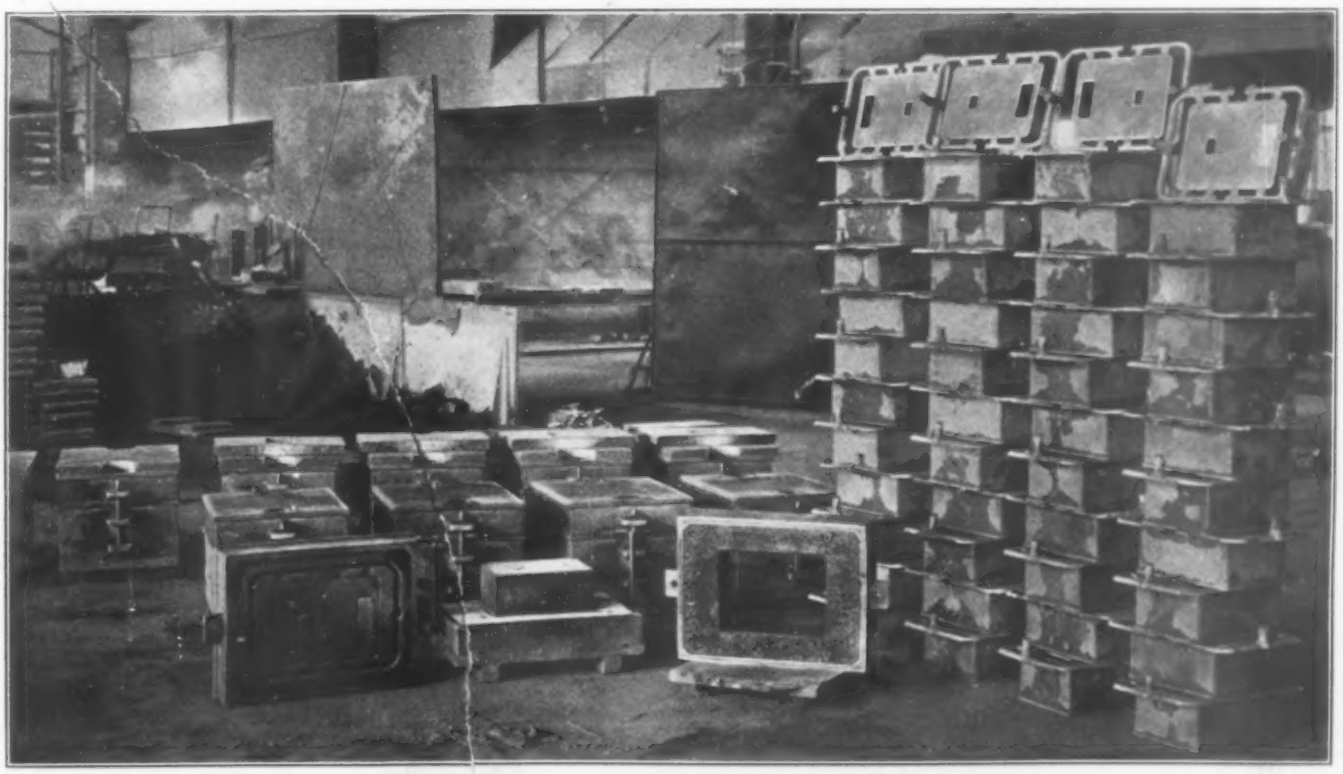


FIG. 1—THE MOLD FOR THE METER BOX CASTING IS MADE ON THREE MOLDING MACHINES, THE DRAG ON ONE, THE CHEEK ON A SECOND AND THE COPE ON A THIRD

FIG. 2—POURING GOES ON CONTINUOUSLY AND THEREFORE A COMPARATIVELY SHORT FLOOR IS ALL THAT IS REQUIRED AT EACH BENCH

seed time and harvest, day and night, heat and cold and the changing seasons. The new generation takes up the burden laid down by the old, sometimes by mutual agreement, sometimes by force or a combination of circumstances, but almost invariably with a suggestion, an appliance or an invention for easing the load.

In the course of 30 years the little brown hands of at least one schoolboy out of a proportionate number will have become broad, thick and strong enough to hold the reins of power over hundreds of his fellow men. One out of a greater number will have amassed a fortune of several million dollars before his fiftieth birthday. Only one out of many millions possibly could equal the record of one Elihu Thompson whose eventful career may be said to have started in 1858 when at the age of five his parents decided to emigrate from Manchester, England, to Philadelphia. Surely none but the most reckless prophet would venture to predict that in 20 years the gentle little English boy would have developed into an electrical genius; that in 25 years he would have started in company with E. A. Houston the Thompson-Houston plant in Lynn, Mass., for the manufacture of electrical machines and equipment on which he held over 500

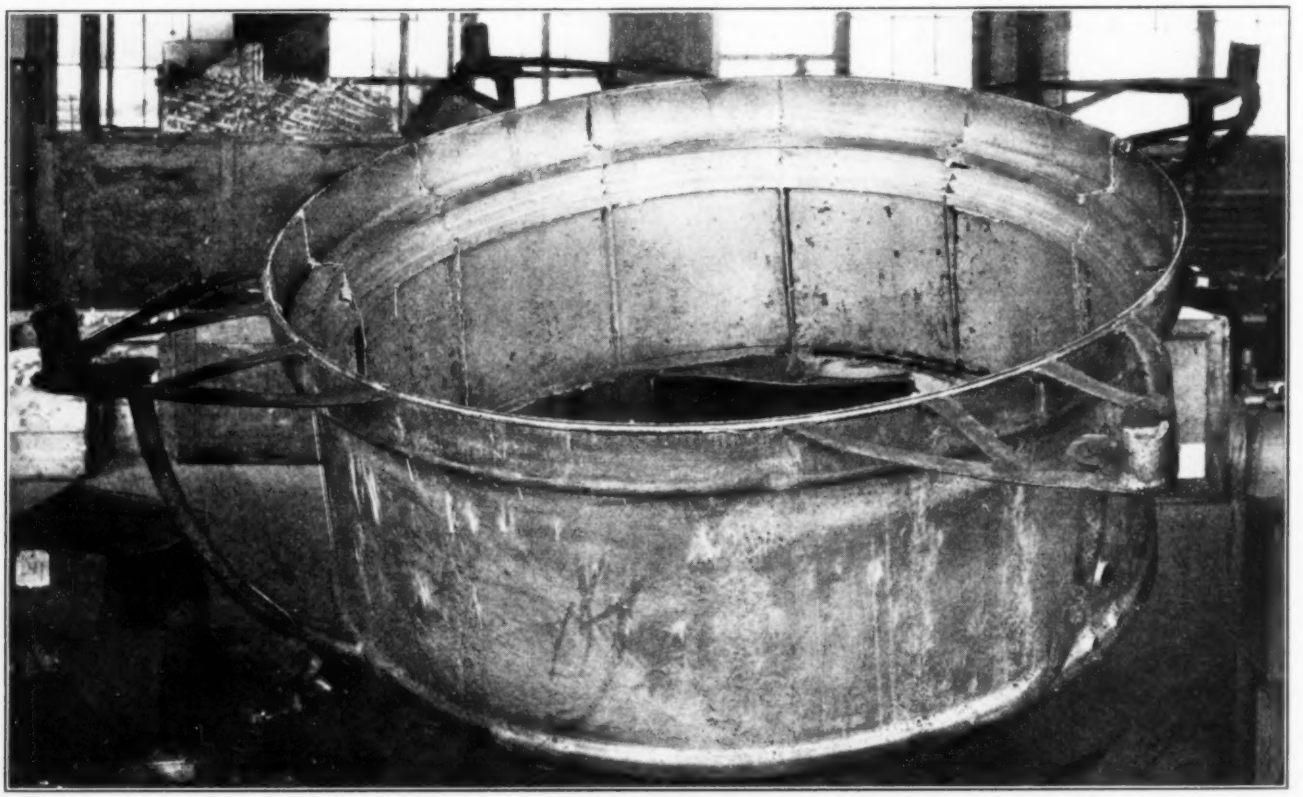


FIG. 3—THE OUTSIDE OF THE MOLD FOR THIS LARGE ALUMINUM CASTING IS SKIN DRIED, THE INSIDE IS FORMED BY A NUMBER OF DRY SAND CORES

patents. A few years later the company was merged with the Edison interests to form what is known as the General Electric Co., the largest manufacturer of electrical machinery and appliances in the world with approximately 100,000 employes distributed between plants in Lynn and West Lynn, Mass., Everett, Mass., Erie, Pa., Pittsfield, Mass., Schenectady, N. Y. and Fort Wayne, Ind. Steel castings are made at Everett, West Lynn, and Schenectady. Iron, steel, brass, bronze, aluminum and special alloys are made at Schenectady, Erie and Lynn. Malleable iron castings are made at Erie, gray iron castings alone are made in Pittsfield, Mass., and nonferrous castings alone are made at the Fort Wayne, Ind., plant.

Show West Lynn Plant

The accompanying illustrations were made at the nonferrous foundry of the company in West Lynn, Mass., which forms part of the plant known as the River works.

The foundry is located on the third floor of a 3-story building approximately 100 x 400 feet. This location was chosen deliberately on account of the exceptional ventilation and light. The building is of steel frame, brick construction with a monitor roof. The walls of the third story, enclosing the foundry are formed of a practically continuous sash and additional light pours through the windows in the sides of the monitor. The interior of the foundry including the walls, ceiling and columns, is painted white and the effect of these various factors is to produce a working room in which the light practically is perfect. This feature is particularly noticeable in Figs. 4 and 5. Arc lamps disposed at frequent intervals under the crane runway and at other advantageous points supply all the light that is required when daylight is not available or when manufacturing operations are carried on by night.

FIG. 5—PART OF THE CLEANING ROOM FLOOR IN THE VICINITY OF THE ELEVATOR AND THE TOILET AND LOCKER ROOM

The floor is surfaced smoothly with cement, a feature which lends itself readily to the dominant note of cleanliness, order and system so strongly in evidence all over the establishment. A smooth floor also facilitates the business of trucking materials from one point to another. All the incoming raw material has to be taken to the various floors, stockrooms or furnaces and all the cleaned castings, refuse from the furnaces, burned sand etc., has to be removed to the elevators for final disposition at the ground level.

Layout Well Planned

The gypsum tile roof is supported on beams resting on the side walls and on two rows of columns extending from one end of the building to the other and automatically dividing the floor into three bays. The division is not arbitrary. In several instances the activities in one bay extend into one or both of those adjoining as, for example, in the cleaning and shipping room shown in Figs. 4 and 5. However, in a general way each of the three bays is devoted to an individual purpose different from the others. An electric 2-ton traveling crane made by the Niles-Bement-Pond Co., New York, spans the center bay and handles all the jobs that are too heavy to be lifted by hand.

That part partitioned off the full width of one bay at the end of the building, shown in Fig. 5, contains the elevator shaft and also the toilet and locker room. The superintendent's office is located in the other side bay directly opposite. Part of the long finishing and inspection bench in front of the superintendent's office is shown in Fig. 4. In addition to the usual methods of cleaning castings, including sandblasting, all the various pieces are examined and if necessary filed by hand by a corps of experts before they are laid before the final inspectors. The castings must conform to an exacting series of tests not the least important of which is a perfect surface appearance.

FG. 4—AFTER THE CASTINGS ARE CLEANED THEY ARE HAND FILED BEFORE UNDERGOING FINAL INSPECTION

Melting Capacity Large

Continuing along the floor in the same general direction, the metal stock room, the melting furnaces, the pattern storage and the aluminum molding floor are located in the right bay in the order indicated. The greater part of the center bay is devoted to a molding floor on which both light and heavy castings are made. The core ovens are located approximately in the center followed by a molding space devoted to the production of aluminum castings. The alumi-

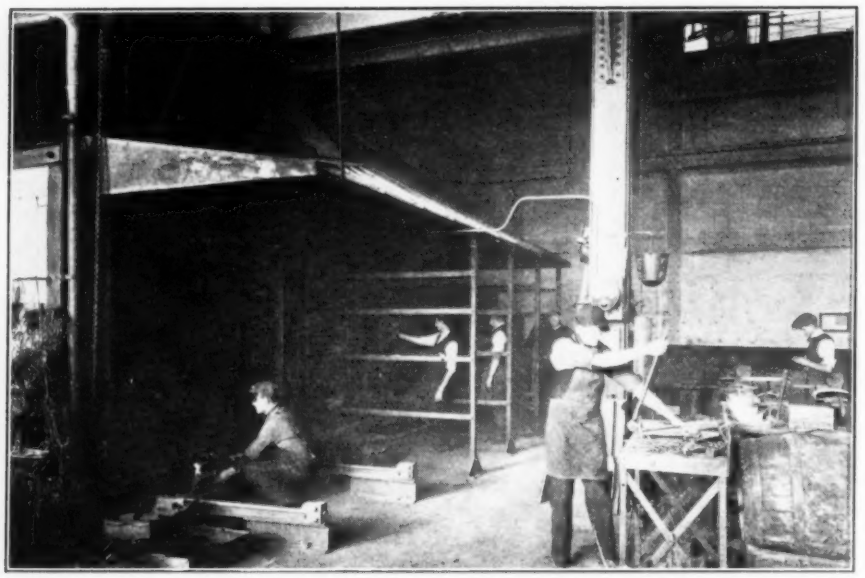


FIG. 6—THE CORE ROOM IN THE VICINITY OF THE CORE OVENS—NOTE THE INGENIOUS TYPE OF SHEARS ON THE BENCH IN THE FOREGROUND

num melting furnaces occupy the entire end of the center bay. The third bay contains the foundry office, as stated formerly, part of the cleaning room, several molding floors and the core room.

The total amount of metal melted monthly fluctuates from time to time depending on manufacturing requirements, but in a fairly representative month the foundry records show that 157,000 pounds of copper-tin and copper-zinc alloys were melted and during the same period 30,000 pounds of aluminum and aluminum alloys were melted. Other interesting figures from the same report indicate that new metal and scrap are charged in the furnaces in the proportion of 40 per cent of the first to 60 per cent of the second. The total weight of castings of all kinds is in the proportion of 75 per cent of all metal charged in the furnaces and the total production of good castings is 65 per cent estimated on the same basis.

Take Pyrometric Readings

The aluminum is melted in a battery of six oil-fired furnaces with capacities ranging from 300 to 650 pounds, made by the Monarch Engineering & Mfg. Co., Baltimore. In addition a small furnace made by the same company is employed for melting small heats, principally for experimental purposes. The metal is closely controlled by pyrometric reading and the pouring temperature is held at approximately 800 degrees Cent. The melting pots have an average life of 125 heats.

The greater part of the aluminum castings are made from the standard No. 12 alloy, but in addition many special castings are made from other alloys, some employed intermittently and others that are regarded as fairly standardized. One alloy of this latter character is silicon aluminum containing 5½ per cent silicon. It is claimed that castings made from this alloy possess the same noncorrosive properties as manganese bronze.

Mixtures Closely Controlled

The wide range of castings made in this foundry are poured from 35 different mixtures regarded as standard and in addition special alloys are made for specific purposes or as occasion may warrant in meeting unusual specifications. Castings are grouped into five main classes according to weight, under 1 pound, from 1 to 5 pounds, 5 to 20, 20 to 100 pounds, over 100 pounds, special castings.

Orders are issued each day from the superintendent's office specifying the formula or special mixture and amount of metal required to pour the anticipated molds on the floor. A duplicate of each order is kept on file in the office, one copy goes to the man in charge of the metal storage and a second copy accompanies the material to the furnace tender. These various orders are turned in at night and together with the time cards and work tickets from the molding floor and core room supply the basis for the office records.

Melt in Stationary Furnaces

Brass and bronze are melted in a battery of 12 stationary crucible oil-fired furnaces furnished by the Monarch Engineering & Mfg. Co., Baltimore. Two single-chamber Rockwell-type furnaces made by the same company each with a capacity of 1700 pounds are employed exclusively in melting copper wire. The metal afterward is poured into ingot molds and remelted as part of the regular charge.

Instead of pouring any metal left in the crucibles, on their return to the furnace, into a sand mold or the ordinary type of rectangular horizontal ingot mold, it is poured into round iron molds set up vertically. These molds are provided in various diameters and the resulting castings are taken to the various machine and assembling shops where they serve the same purpose as regular *stick* brass made in the orthodox manner. The mold is split in two vertically to facilitate the removal of the stick and also so that it may be oiled occasionally to prevent a damp surface. In this manner the leftover metal instead of appearing on the report sheet as scrap is listed under the head of castings.

Hard and soft solder, babbitt metal and metal intended for die casting purposes are melted in two oil-fired pot furnaces, dipped out and poured into ingots.

Suction fans and suitable hoods over the

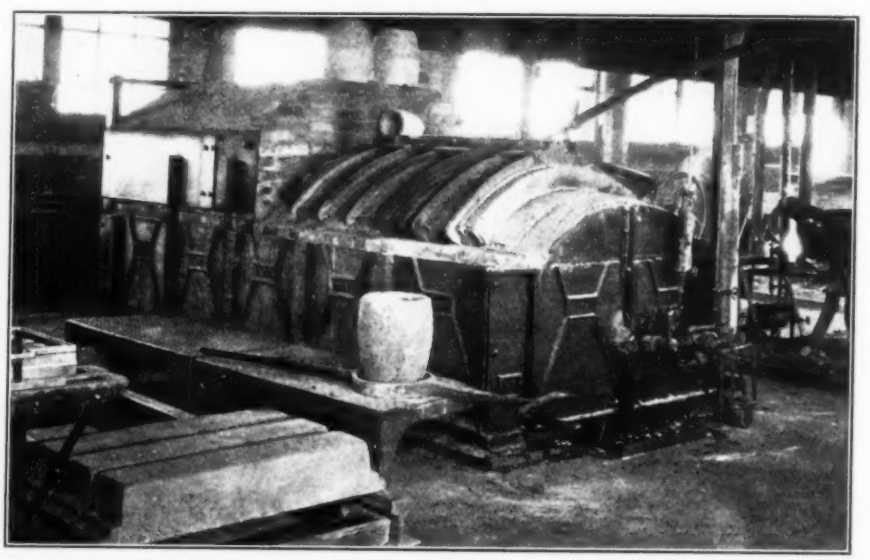


FIG. 7—AN OIL FIRED FURNACE WITH REMOVABLE TOP IS EMPLOYED FOR ANNEALING AND HEATING THE CRUCIBLES

various furnaces serve to remove practically all the smoke and fumes generated in the vicinity. What little escapes into the surrounding air quickly is dissipated and drawn out through the monitor on the roof.

The metal is melted in and poured from crucibles and with such a large number constantly in commission it is essential that spare crucibles should be kept on hand in condition to instantly replace any that should happen to fail in service. Foundrymen who use crucibles are familiar with the precautions necessary to be taken before they are placed in service. They are received from the manufacturer at atmospheric temperature and although they may be packed in straw in a dry container they probably will have absorbed a little moisture from the air. If they are placed in the fire in this condition, large spalls will fly from the bottom and sides and render the crucible worthless. They must be heated gently and thoroughly before they are placed in the melting chamber.

Crucibles Heated Gradually

In the brass foundry of the General Electric Co., at West Lynn, the special oil-fired furnace shown in Fig. 7 is employed for the purpose. It is divided into several chambers each one of which is maintained at a successively greater temperature and the crucibles are transferred from one to another, commencing in the chamber with the lowest temperature and finishing in that with the highest temperature. Thus they enter the annealing furnace cold and emerge red hot.

Crucibles that no longer are in condition to melt metal are pulverized in a mill and mixed with carborundum to form a lining material for the various furnaces.

A 12-foot length of 3-inch pipe supported by a chain attached to one of the roof beams is employed for lifting the bungs on and off the furnace. The lower end of the chain terminates in a collar through which the pipe may slide back or forth and in that manner the lifting hook may be adjusted directly above any one of the bungs. An old bag wrapped around the outer end of the pipe furnishes heat insulation and prevents the operator's hands from coming into direct contact with the bare pipe.

Small cores are dried in a battery of four, oil-fired, rack core ovens supplied by the Whiting Corp., Harvey, Ill. The front of these ovens is shown in Fig. 6. Larger cores are dried in a car type oven supplied by the same concern. A single burner furnishes all the heat required in each individual oven. Temperature control is effected by pyrometer readings. One of the pyrometers made by the Wilson-Maeulin Co. New York, is attached to each oven. Instruments furnished by the same company are employed to determine the temperature of the aluminum melting furnaces.

An example of a large aluminum casting 6 feet diameter, 30 inches high, average metal thickness ¾-inch is shown in Fig. 3. The method of making the mold and pouring the casting also are apparent in the same illustration. The outside face of the casting was formed in a skin dried mold and the interior was formed by a set of dry cores assembled in a suitable print provided by the pattern. These cores were made from a mixture containing a maximum amount of old sand and a minimum amount of core binder and consequently crushed readily while the casting was contracting. The metal was poured from four ladles into sprues at each of the four corners of the flask. Each sprue was connected with a long horn gate that delivered metal to the bottom of the mold. The sprue also served four branch gates cut at the joint of the mold between the cope and drag. After the casting had set, the cores were dug away at four opposite points to facilitate contraction.

Many of the larger castings in aluminum and brass are made in the foregoing manner. It is apparent that the method may be adapted to meet varying conditions depending on the shape and size of the pattern. Among its advantages may be pointed out; a saving in time, a stronger pattern, an insurance against many of the accidents incident to an intricate mold, and the job is brought within the capacity of the ordinary molder. Certain castings still are made in a manner that requires a high degree of skill on the part of the molder and patternmaker, but the tendency all the while in new construction is to simplify so far as possible every operation.

Machine molding floors are shown in Figs. 1 and 2. Molds are made on machines supplied by the Arcade Mfg. Co., Freeport, Ill., Henry E. Pridmore, Chicago, and the International Molding Machine Co., Chicago. In the greater number of cases the men work singly, in a few instances they work in pairs and on the meter cases shown in Fig. 1, three men form the crew.

In the reduced illustration it is impossible to discern the finely *pebbled* surface on the face of the meter cases referred to in Fig. 1. The design is exceedingly fine and delicately engraved and yet if the casting does not reproduce it in the most perfect detail it is rejected. The casting is only 3/16-inch thick and is held closely to specifications covering shape, size, metal thickness, weight and color.

The molds are made by a team of three men operating three machines supplied by Henry E. Pridmore, Chicago. One man makes the drag on a rollover, jolt machine, the second makes the cheek on a jolt, stripping plate machine and the third makes the cope on a plain squeeze machine. By referring to Fig. 1 it will be noted that the runner at each end and the gates are in the cope. Other pertinent features about the equipment that probably will not reproduce clearly in the illustration are the flask guides and planed joints.

The adjoining faces of the flasks are accurately planed and fitted and a long guide pin is firmly bolted to a lug on each end of the drag. In addition to locating the cheek, the pins extend upward a sufficient distance to locate the cope also. The castings are poured at periodic intervals all during the day and in that manner a comparatively small number of flasks is sufficient to produce the daily quota. The guide pin holes are provided with bushings which are removed at the slightest sign of wear and replaced by others that fit the pins accurately and closely.

Produced in Quantity

Many of the castings in this foundry are made in large quantities and sample castings are made and checked carefully before the pattern is placed in regular production. The equipment is designed to render the molding operation as nearly mechanical as possible and thus reduce to a minimum chances of error due to the human factor.

Copper coils for transformers and meter fields in which the conductivity is rated at about 92 per cent are poured in collapsible iron molds from pure electrolytic copper ingot metal and some return scrap from the machine shops of practically the same composition.

The cleaning equipment is all motor driven from beneath and includes several sprue cutters, grinding wheels and band saws, one revolving sandblast barrel made by the New Haven Sandblast Co., New Haven, Conn., one wet tumbling barrel for recovering screenings, made by the W. W. Sly Mfg. Co., Cleveland and one magnetic separator for removing ferrous material from the scrap, made by the General Electric Co.

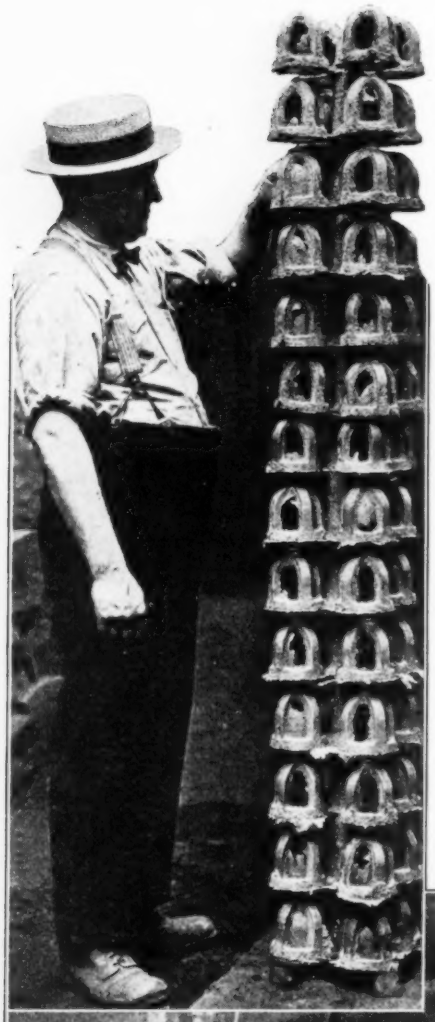
Devise Carbon Monoxide Recording Instrument

The Pittsburgh station of the United States bureau of mines is devising an instrument to record continuously carbon monoxide over a range of concentrations up to about 10 parts in 10,000. When the instrument is set up, it will be calibrated with known mixtures of carbon monoxide in air. If it proves practicable, the instrument can be used around blast furnaces, metallurgical and chemical plants and other places where a carbon monoxide hazard exists.

Foundryman Develops New Practice

Ingenious Devices and Molding Operations Have Been Introduced in Gray Iron and Steel Shop

BY H. E. DILLER



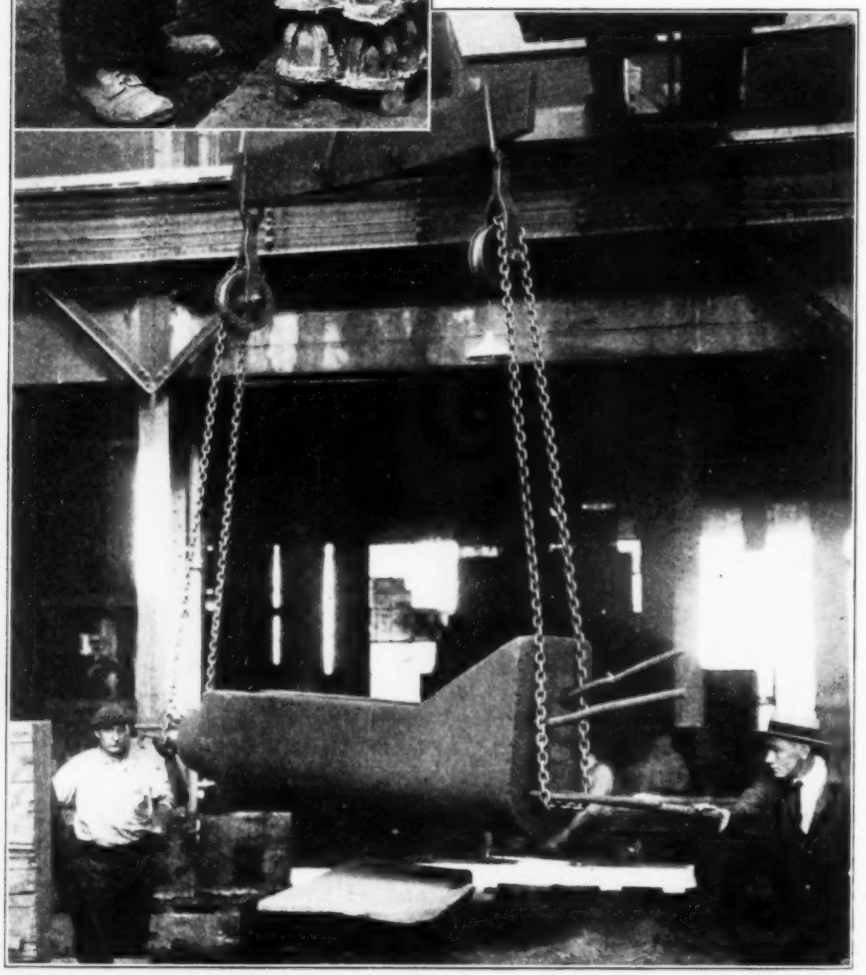


FIG. 1—MULTIPLE-CAST STEEL VALVE CAGE FIG. 2—ROLLING OVER CORE

IN THE average technical journal little of the human interest ordinarily is served. The pages frequently contains some of the dogmatic beliefs of the enthusiast and changeable so-called facts of a varying science, recording the ebb and flow of the ideas propounded by the student and the worker. The theory of the necessity for low sulphur in steel is superseded by a letting up of the urgency of this dogma and a swing to the claim that steel is benefited by sulphur. The smallest divisible state of matter known as the atom on which is based the science of modern chemistry is announced to be a myth and it is shown that the atom is made up of particles of force.

In writing of foundry practice this jumble of dogma and science is somewhat submerged in accounts of the accomplishment of results bringing advancement to the structure of civilization. Occasionally, too, a note of personal interest slips into the pages of dull facts and theories. The achievements of the foundryman who was awarded the Obermeyer prize at the Rochester convention of the American Foundrymen's convention is certainly one filled with interest for all foundrymen. His work should prove an incentive to the younger workers starting in the industry.

This prize, offered for the best original idea for improvement of foundry processes was awarded last year to Edwin Jory, foundry superintendent, the National Transit Pump & Machine Co., Oil City, Pa. As noted in THE FOUNDRY, June 15, 1922, the device which won the prize was a method of handling green-sand cores in the mold. At the convention it was fitted up for making 3-way valve cores of green sand and introducing them in the mold. The core is made in a split box, one half of the corebox is removed, the drag section of the mold is inverted and attached to the remaining half of the corebox containing the core, then both corebox and drag are rolled over together. Now when the corebox is removed the core is left in the drag and the cope is closed on top leaving the mold ready to pour.

Trained in England

Naturally it is interesting to know something of the man who won in open competition with all the other foundrymen of the country. Mr. Jory was born in England, and like many other youths in that country in bygone days, started to work at an early age, having been associated with the foundry industry since he was 12 years old. He received the thorough training given to apprentices in the old country, in the shops of J. & H. Gwynn & Hammersmith Co., London. This firm was at that time the leading manufacturer of pumps in England, making a line ranging in size from 2 to 60 inches. Mr Jory worked in both the gray-iron and the brass foundry and rose to the position known in England as the *leading hand*, corresponding to what is known popularly in this country as *straw boss*.

The first move of the young molder

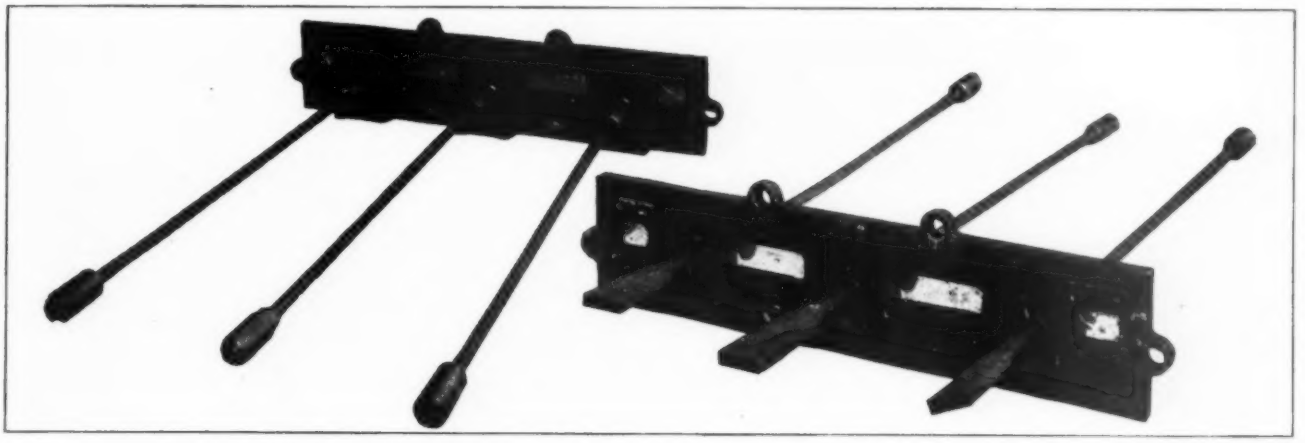


FIG. 3—VIEWS OF THE OUTSIDE AND INSIDE FACE OF A CONTRIVANCE USED TO KEEP THE CONVERTER TUYERES OPEN—IT IS BOLTED TO THE WINDBOX AND THE RODS SLIDE THROUGH THE PLATE ON BALL JOINTS

was to the foundry of the British Thompson-Houston Co. at Rugby, the English branch of the General Electric Co. Here he became subforeman and secured experience in making castings for electrical machinery. Looking for a greater opportunity to advance in his trade he moved to America and secured employment in the foundry of the General Electric Co., Schenectady, N. Y., where he had work similar to that he was doing in the English plant of the company. He was not with this company long until opportunity for advancement offered itself in the form of a position as general foreman for the Davis & Namack Foundry Co. in the neighboring town of Balston Spa. This company made locomotive cylinders and superheaters, and at the time Mr. Jory took the position with them the production of superheaters was in its infancy, so that much study and experiment was necessary before the percentage of wasters was cut down to a reasonable figure. However, it was not long until the castings loss was cut to less than 5 per cent.

When Mr. Jory went to the National Transit Pump & Machine Co., he had to familiarize himself with the production of steel as well as gray-iron castings for this company has both a steel and a gray-iron foundry. Fig. 1, which shows Mr. Jory with a gate of multiple-cast valve cages made of steel, gives an indication of how he succeeded in this work. These cages were molded in 12-inch flasks. After the sand is struck off and dried the mold is set on top of the previous mold in such a manner that the bottom of the flask forms the cope of the mold. They are poured from the central down gate as indicated in the illustration. Besides effecting a saving in molding expense this method almost entirely eliminates castings with cold shots, thus increasing the output of the molders.

Of course, in a steel foundry the melting and steel making equipment must be mastered thoroughly. The equipment of the National Transit company, which uses the converter process, was altered slightly by Mr. Jory and the process carefully worked out. The stock is melted in a 40-inch cupola. The 1500 pound charges are made up of from 35 to 45 per cent steel scrap and the remainder low-phosphorus pig iron. The bed of the cupola is built high, about 35 inches above the tuyeres, and when not melting heavy chunks of steel scrap, 150 pounds of coke are added between charges. However, when sink heads are charged it is necessary to add 200 pounds of coke between charges on account of the difficulty in melting these pieces with

FIG. 4—FERROALLOYS ARE THROWN INTO THE CONVERTER FROM AN EXTENSION OF THE CUPOLA CHARGING PLATFORM USING AN OPENING IN THE HOOD

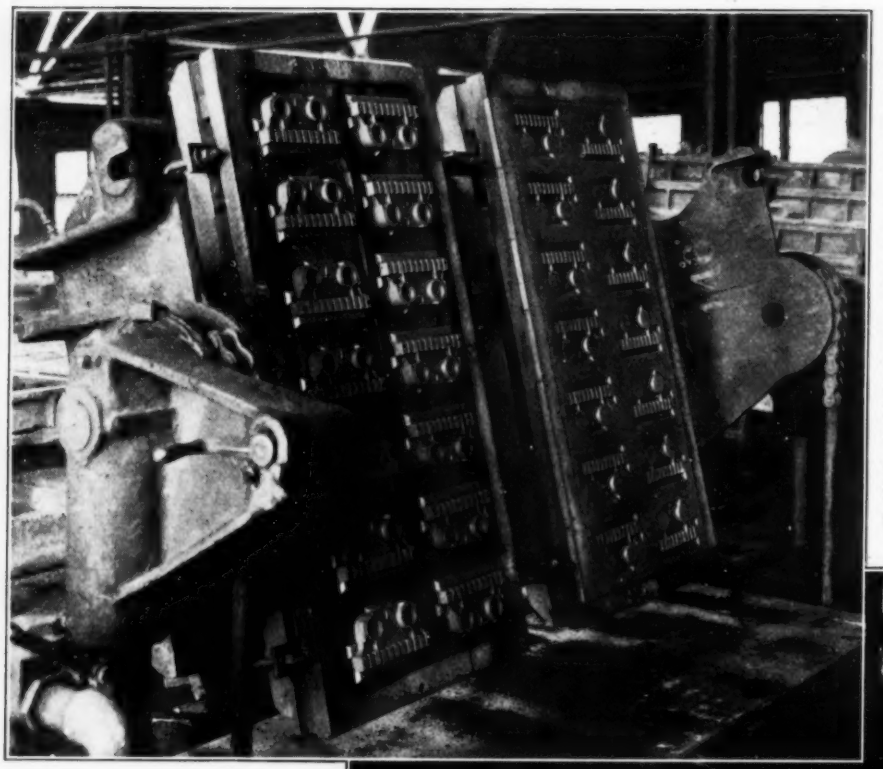


FIG. 5—ABOVE—THE COPE AND DRAG ARE MADE AT THE SAME TIME ON A ROLL-OVER JAR MACHINE FIG. 6—AT THE RIGHT—MOLDS ARE STACKED FIVE HIGH FIG. 7—BELOW—ARBORS FOR LINER CORES ARE SET BY THE CRANE WHICH ALSO DRAWS THE CORES

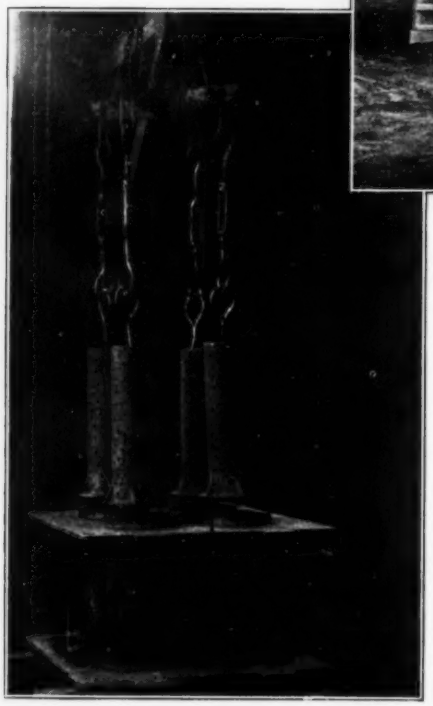


Fig. 3 is bolted over the oblong opening at the back of the windbox. This is an arrangement for keeping the tuyeres free at all times during the blow. The steel bars shown sticking through the plate are set on ball-socket joints so they can be moved in any direction and either in or out. Thus the heavy ends, shown at the front in the section at the right, Fig. 3, can be guided to reach all points on the tuyeres and knock off any obstruction which may attach itself to the tuyere. As may be noted, sections of glass are set in the plate to enable the operator to see what the condition is in the windbox and at the tuyeres. This device is readily attached, only a few bolts being required, and when it is removed a large opening is made to clean out of the windbox any slag or metal which may have been deposited there during the operation of the converter.

large cross sections. The presence of heavy scrap in the charge also affects the blast requirements. Ordinarily, the blast pressure is kept down to between 8 and 10 ounces to prevent excessive oxidation of the steel, but when heads are used in the mixture a blast of 12 ounce pressure is found to give better results.

In the morning before starting to blow steel, the converter is heated thoroughly with oil by burners placed in the opening in the wind box of the 5-ton converter. Ladles also are heated by oil burners to prevent the metal from cooling too rapidly. After the converter has reached the desired temperature the oil burners are removed and a plate, as shown in

Blowing Pressure Increases

Metal from the cupola is poured into the converter from a ladle carried by a crane. At the early stages of the blow, 2½ pounds of air is used but as the blow progresses the air pressure is increased until 3½ pounds pressure is obtained. This is controlled by the steelmaker who governs all operations by valves as he stands behind a protecting screen at the side of the converter. As may be noted in Fig. 4, which also shows the screen at the right, a steel segment of a circle is attached to the

one support of the converter, and is marked off to enable the operator to determine the degree to which the converter is tilted.

After the blow is finished, ferromanganese and ferrosilicon are added to the metal in the converter in the lump form. When this addition is made metal is sometimes splashed from the converter. Therefore to avoid possible injury to the workmen from this source and to prevent metal splashing into the foundry the alloys are added from a platform extending from the cupola charging floor through a hole in the hood over the converter, as shown at *A*, Fig. 4.

Another ingenious device is the rig designed for rolling over heavy cores and flasks in the air. This consists of two wheels carrying endless chains, which are attached to a yoke carried by a crane. Pipes set in the core serve to anchor the ends of rods inserted in them. Then the chains are placed around the steel rods as shown in Fig. 2, and by rolling the chains on the wheels the core is turned to any angle desired. In the illustration, the chains are shown wedged between the wheels and the yokes which hold them. This method is used when it is desired to carry the core or mold without rolling it over. It may be seen how much simpler this method of rolling over a core is than to set the core on a bed of sand and roll it over with hooks as would be the case if the special sling were not used. The same method is applied to flasks and molds, although with these it frequently is necessary only to put the chains around the body of the mold instead of attaching it to lugs on the end.

Sand Handling Equipment

The gray-iron foundry is in a building parallel to and immediately adjoining the steel foundry and so the gray-iron and steel melting cupolas are placed beside each other and are served by the same platform, the molten metal being carried to the gray-iron foundry on a transfer track. This foundry, 52 x 288 feet is divided lengthwise into two sections by a gangway. The smaller castings are made on the one side and the heavy machines are located on the other. At the one end of the heavy-work floor is a sand handling device. The molds, after the castings are poured, are carried to the end of the shop by one of the three traveling bridge cranes which serve this section of the gray-iron shop, and here dumped. The sand is then cut and tempered and dropped through a grating into a bin from which it is raised to the 30-ton hopper, shown above at the right, by a bucket conveyor. The chute shown beneath the hopper turns

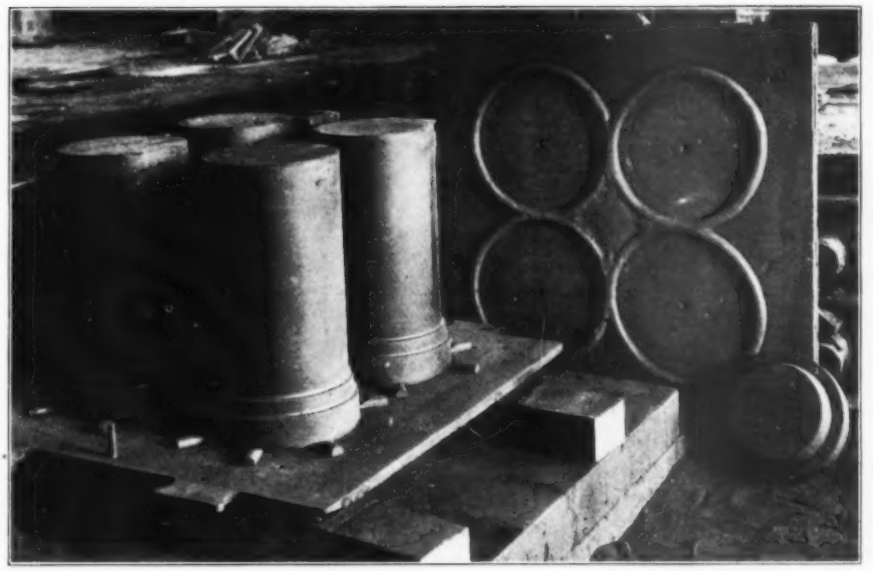


FIG. 8—LINERS ARE MADE WITH A CHEEK, DRAG AND COPE—NOTE THE PATTERN FOR THE CHEEK AT THE LEFT AND THE BOARD FOR THE COPE AT THE RIGHT

on a bearing so that the sand may be delivered into buckets to be carried by the crane to other floors, or may be dropped directly into a flask on the machine shown in the illustration.

This machine is a rollover jolt machine built by the Osborn Mfg. Co., Cleveland. In the illustration it is shown with both the cope and drag patterns for chain grate links attached. As may be noted from Fig. 5 which is a close-up view, 14 castings are molded on a long central gate. Each flask is 6 inches high, 28 inches wide and 66 inches long. After the mold is jolted and struck off, the whole is rolled over onto the carriage of the molding machine, the bed plate being raised to enable the carriage to be placed underneath. Then the carriage is drawn to the front, the drag is placed on the pile of molds shown at the left, Fig. 6, and the cope is set on top of it fitting into guide pins which insure a correct joint. As may be noted in Fig. 6, the cope and drag of the lowest mold on the two piles are held together by *C* clamps, then similar clamps are used on the side to hold two entire molds together. Five molds are placed on a pile with the pouring gate of the under mold cleared by the mold on top of it in each case. The lowest mold is poured first and so on until the top mold is reached. In this way molds cannot be spoiled by spilling metal into them, as might be the case if the top mold was poured first and metal spilled

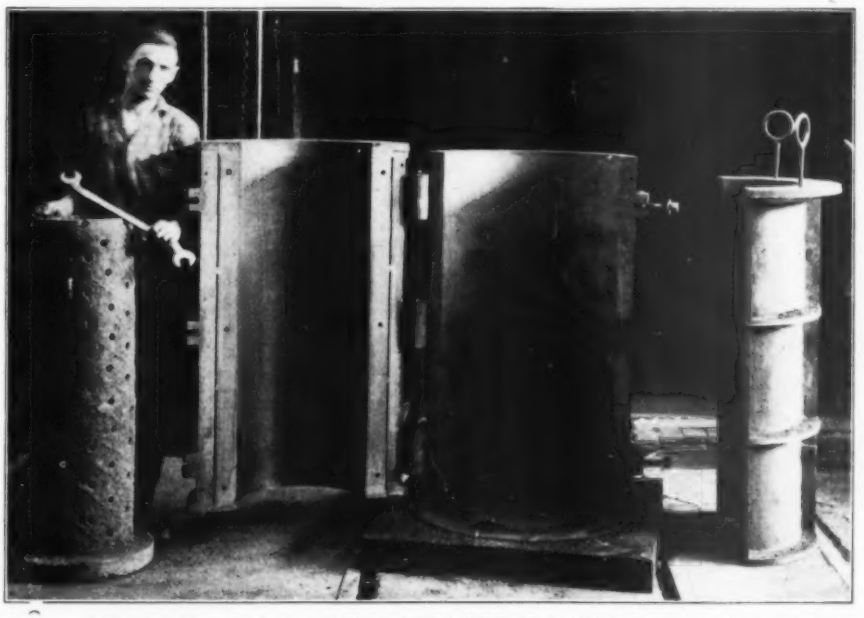


FIG. 9—CORES FOR LARGER LINERS ARE MADE INDIVIDUALLY—SECTIONS ARE INTRODUCED INTO THE BOX TO MAKE CORES OF DIFFERENT SIZES

from the ladle into the gates of the molds below.

One casting, of which the company makes great numbers, and consequently has developed by close study and application an efficient method of molding, is cylinder liners. These are made of gray-iron and the mold consists of a drag, cope and cheek, with a core in the center. Fig. 8 shows the pattern for the cheek at the left, the pattern board for the cope at the right, and at its lower right-hand corner the pattern for one of the four core prints which fit on the drag board.

As may be noted from the pattern for the barrel, four castings are molded in a flask. The cheek mold is jarred on a plain jolt machine, made by the Herman Pneumatic Machine Co., Pittsburgh. It then is rolled over and set on the drag by the crane which also draws the plate of patterns. As may be noted from Fig. 8, a number of short gates are placed around the head of the pattern. These are connected with runner gates in the cope, which entirely surround each casting, as is indicated by the pattern on the cope board, Fig. 8. A down gate 1¼ x 1½ inches in the center of the cope is connected with each circular runner. As indicated by the description given, the cope consists of a plain flask containing the impressions for the circular runners, and the drag contains the impressions for the core prints. All flasks are machined accurately so that the parts are interchangeable, and any cope or drag will fit on any cheek.

Like the patterns, cores are made in sets of four for the smaller liners, while cores for the larger castings are made singly. Fig. 7 shows a corebox with the arbors ready to be set in by the crane. After the box is jolted the cores are drawn by a crane in a manner similar to the way they are placed in the box. The crane hooks are attached to steel rods inserted in the arbors, each end of the rod resting in a hole in the arbor. These holes primarily are a means for venting the core.

With the present method of molding in which the metal enters the mold at the top instead of being bottom poured, it is necessary to dry the cores, but formerly, when the mold was bottom poured, green-sand cores were used. The core sand is brought to the job from the mixer in boxes carried by the crane. It then is mixed with sawdust and riddled, as it has been found that the addition of saw dust to the mixture causes the sand to break up readily after the castings are poured.

Cores for the larger liners, as has been mentioned, are made singly. Fig. 9 shows the corebox for such liners. As may be noted one half of the box swings on hinges and the two halves are clamped together with hinged bolts. With an open corebox it is easier to place in the arbor and the sections used to adapt the corebox for different sized liners. A half of one of these sections, containing the eye bolts for handling it with a crane, may be seen at the right, Fig. 9. By the aid of these sections a number of different diametered cores can be made in the same corebox. If a shorter core is required, it is secured by placing a stool in the corebox. The arbor at the left is similar to the ones used in the smaller liners and is handled by the crane in the same way. The diameter of the liner is such as to give about a 2-inch thickness of sand in the core. Thus the arbor conserves sand and permits the core to be cleaned out of the casting with ease.

The use of cement facing on many of the green-sand molds has been adopted at the National Transit shop and no injurious effects have been found from the cement mixing with the sand and gradually becoming of such proportion as to lower its venting properties as is claimed by foundrymen who object to its use.

Plan for Visitors' Pleasure

TENTATIVE plans for the entertainment of visitors at the Cleveland convention of the American Foundrymen's association and related organizations, April 28 to May 3 are nearing completion. At the same time the Metals Division of the American Institute of Mining and Metallurgical Engineers, the American Malleable Castings association and the Foundry Equipment Manufacturers association will hold their several meetings and in consequence over 4000 delegates and visitors are expected in the city. A local committee composed of foundrymen, equipment manufacturers and supply producers has charge of the arrangements for special entertainment features.

A ladies reception committee has been formed to assist in receiving the visiting ladies. A hostess will be stationed in each hotel by this committee, and others will be in attendance at the ladies headquarters in the Cleveland public hall.

On Tuesday, May 1, at 11 a.m. automobiles will be provided to take the ladies for a drive through the east side park system to the Wade Park manor, where they will be tendered a luncheon by the Cleveland organization. This will be followed by an inspection of the Museum of Art, one of the finest art galleries in the country. A special concert will be arranged in the conservatory of the museum, following which the automobile sight-seeing trip will be resumed.

Tuesday night will be devoted to a theater party, the entire Keith Palace theater has been chartered for the occasion. This theater, which seats about 3500 people is one of the most beautiful and costly show houses in the United States and its opening late last fall attracted attention throughout the theatrical world. An exceptional vaudeville bill will be arranged for the foundrymen's night.

A second automobile trip over the city is planned for Wednesday, the western part of the city and Lakewood being included in the route suggested. A card party and tea will be held at one of the beautiful clubs along the shores of the lake.

Wednesday night, May 2, is set aside for the annual subscription banquet of the American Foundrymen's association. This will be followed by a reception and dance, offered by the local foundrymen and manufacturers.

Cast Iron for Enameling

As it has been claimed that gray cast iron, for example, such as that used for bath tub castings, varies widely in its enameling properties, the bureau of standards has been examining specimens to determine wherein the differences lie. Twenty specimens of cast iron were obtained from different manufacturers and examined as to microstructure but no differences which could be considered of importance in affecting their enameling properties have been found. The work, however, will be continued, according to reports of the bureau of standards.

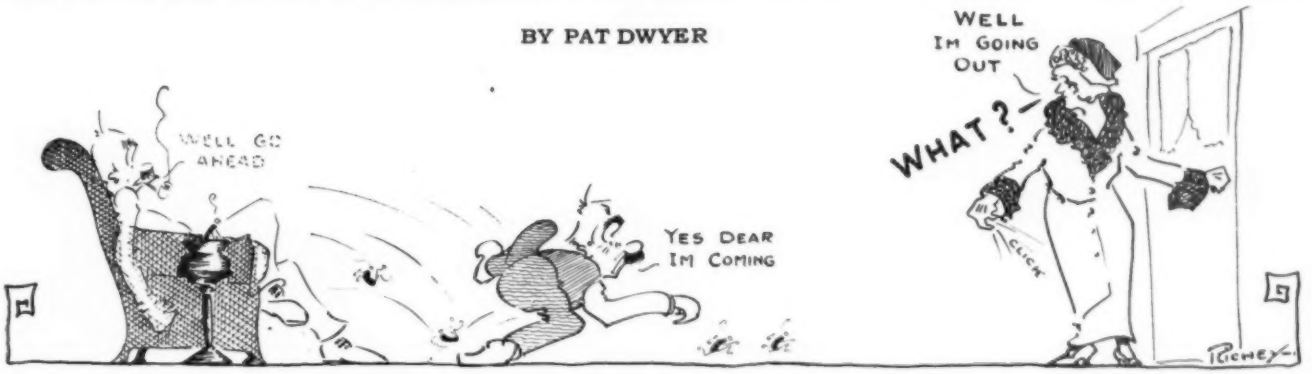
Appoints Sales Agents

The Pulaski Furnace Co., recently placed the sales agency for its pig iron with Alley & Page for New England, Rogers Brown & Co., for New York City, New Jersey, Pennsylvania and the West and with Matthew Addy Co. for Maryland, Delaware and the South. Richard Peters Jr., Philadelphia has resigned as manager of sales.

The Franklin institute, acting through its committee on science and the arts, has awarded H. A. Greaves, jointly with H. Etchells, its Certificate of Merit for notable and original inventions embodied in the Greaves-Etchells type of electric steel melting furnace.

Bill Makes Column Bases in Green Sand--III

BY PAT DWYER



ABOUT a week after Bill and his family with all their worldly goods and chattels, including a villainous looking tom cat for some incomprehensible reason known as Angelina, had moved from one house to another, my one and only wife proposed that we pay a friendly visit. I never expect to merit or receive a prize in recognition of my ability as a willing or experienced visitor, but when the lady tells me she has made up our mind to go out, I do the same as you do under similar circumstances. We were received hospitably and shown all over the house from the attic, fitted up as a sleeping room for two of the boys, down to the basement which seemed to have a meter of some kind in every corner. Through some peculiar association of ideas the place reminded me of that famous classic dealing with what undoubtedly is the most notorious farm in the world down on the O-h-i-o. With a click-click here, a click-click there, here a click, there a click, clickers everywhere. The meters were more refined and—shall we say discreet?—than some of the mythical animals credited to the farmer and most assuredly they were not as noisy as the gang when it sets out to sing the farmer's litany. However, noise is not always to be regarded as a measure of efficiency and the readings on the various meters indicated that the public service corporations engaged in the sale and distribution of gas, water and electric current were taking no chances.

We listened politely to the wholesale condemnation of the former house and the enthusiastic enumeration of the many advantageous features of the new one. We have been through the same experience many times and therefore the recital did not mean anything. By the time Mrs. Bill has been in the house a year or two I feel satisfied that she will have discovered it has more faults than the old one. Many years ago I learned that cows have long horns.

While the ladies were engaged in an animated discussion touching on the relative merits of willow and upholstered furniture, Bill showed me an old scrapbook he had found, evidently overlooked or forgotten by the former tenants. From the character of the majority of the clippings dealing with household and beauty hints I assumed that the collection was the work of a lady and by a further application of the ingenious methods developed by the late Mr. Holmes I found that the book had been compiled between 1874 and 1879. Marvellous? Not at all, my dear Watson, not at all. The date line appeared on many of the newspaper clippings!

Twelve or fourteen pages at the back of the book had not been utilized probably for the same reason that no scrap book ever is filled. After a time the novelty wears off and the owner takes no further interest in it. In the present instance the unfilled pages were even more interesting than those that were covered. The scrapbook maker had utilized an old day book from a small town general store and the pages at the end presented the entries from day to day for a period between March 2 and March 26, 1863. Practically the same list of names appear on every page and the various items purchased threw an interesting side light on the commodities supplied and the prices charged in the old war days.

Apparently water, as a beverage, was unknown for the item most frequently listed was "One bottle Old Tom, 50 cents."

Bill directed my attention to the name of one customer in particular. For several days in succession his sole purchase apparently was a bottle of the famous old invigorator. Then one day his name appeared opposite a long list of provisions and other supplies including a bag of flour, a peck of potatoes, 10 pounds beans, 6 lemons, ½ pound tea, 1 gallon molasses, 3 pounds sugar, 2 quarts oil, peppermints 10 cents, half dozen candles and three bottles of Old Tom. Bill suggested that the old boy probably staged a party in the old homestead that night. On the following day his name appeared opposite one bottle Old Tom, 50 cents and on the third day he bought some writing paper, a bottle of ink, one bottle of castor oil and one pick handle. Bill seems to think that our hero enjoyed himself too strenuously at the party. The writing paper and ink would seem to indicate that he contemplated making a last will and testament, but whether as a result of taking the castor oil or as a protest against taking it, unfortunately there is no further evidence. True, the item of the pick handle lends a certain air of credence to the theory that he intended to protest, but then on the other hand as Bill logically pointed out, it may have been that some other member of the family refused to take the remedy—instances of the kind are on record—and then it would seem that as head of the house he intended to use the pick handle as a persuader. "You know" said Bill, "rarely is it safe to draw conclusions from the first evidence submitted and for the same reason it is difficult at times to decide on the best methods for molding a certain casting. After all in nearly all cases local circumstances furnish the deciding factor. I have dwelt briefly on a few alternative meth-

EVEN SO THERE IS A KICK IN IT

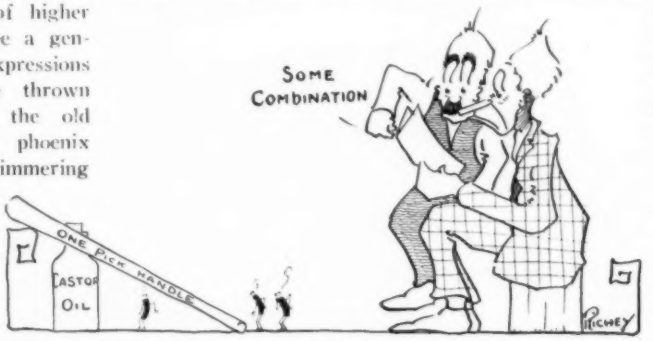
ods of making column bases and this seems to be as good a time as any other to touch on what I consider the best of the lot. In the accompanying illustration it will be noted that in this method the small base is formed between an upper and lower core.

"Strictly speaking the two bodies of dried sand employed to enclose the lower base are not cores. They form the outside face of the casting and cores, as the name implies, form holes in the casting. However, like many other misapplied terms in the foundry, any individual body of sand baked in an oven is known as a core, irrespective of whether it is destined to form the interior or exterior of a mold.

"Some day, perhaps when the foundry business takes its proper place as one of the learned professions and all candidates for admission must present credentials from a reputable seat of higher education, we may expect to see a general purification. All rough expressions and ambiguous terms will be thrown on the figurative dump and the old foundry vocabulary will rise phoenix like from the ashes clean, shimmering and iridescent as the neck feathers on a pouter pigeon. Consider briefly the word flask, or to be more accurate its colloquial equivalent *flast*. This word is applied either to cope or drag or to both together. It may mean a single section or a dozen sections piled on each other. It is used in connection with a frame filled with sand or with one that is empty. A workman claims that he puts up 100 *flasts* for a day's work, when it is apparent to any observing person that he employed the same snap flask all day and that what he really accomplished was to place on the floor 100 cubical bodies of sand, each one of which contained one or more mold cavities. Following along the same line he is told that his rate of pay is so much a *flast*, when in reality his pay is computed from the number of perfect castings that finally pass the inspector.

"The term gate is manhandled almost as wickedly. It may apply to the entire channel leading from the lip of the ladle to the face of the mold or it may be limited in its application to any specific part of that channel. Most curious distortion of all, after the casting has been poured and the metal has set, the body of iron remaining in the channel is referred to as the gate. Clearly if the open passage provided for the molten metal is a gate, it is absurd to refer to the metal which fills the passage also as a gate.

"No wonder outsiders find foundry terms so confusing. Imagine the natural bewilderment of a stranger informed in the morning that a small opening or passageway extending from end to end of a cylindrical core is a vent. Later in the day he observes a flame half a yard long spouting from the same opening and the good natured lad to whom he applies for information touching on the correct technical term cheerfully tells him that the flame is called a vent. If anything is needed to polish him off he finds it in the chipping room where occasionally he finds a casting with long, slender pieces of metal resembling icicles appending to it. If his curiosity prompts the inquiry he will learn that these stalactites also are known as vents. The term is applied indiscriminately to an opening in the sand, a flame and a piece of iron and the visitor may be pardoned for harboring a suspicion to the effect that a vent is something mysterious and uncanny when he hears the old man direct a boy to shove a hot skimmer under the bottom board to 'touch off the vent.'



OLD TIME REMEDIES GUARANTEED TO KILL OR CURE

"In one shop when a molder desires assistance to place the cope on the drag he will announce that he is going to 'close 'er up.' In another shop, sometimes in the same vicinity, he will claim that he is going to 'close 'er down.' He may add a few other supplementary words depending on circumstances, but these are fairly well standardized and do not vary to any extent from one shop to another. Occasionally a young man develops a new epithet or a new application of an old one, but speaking generally the field has been cultivated so intensely and for such an extended period that the soil practically is exhausted. After a man has commented on another's features, peculiarities, nationality, parents, ancestors immediate and remote, has invoked the assistance of the Deity along certain lines that would destroy the peace and comfort of the party of the second part and has intimated in a general way that the aforesaid party is heading for an exclusive community where pyrometers of special design have supplemented the ordinary thermometer; after a man has touched on all these points there is little left.

"Notwithstanding all these apparent drawbacks, foundrymen pursue their activities with a minimum of confusion. Either through long usage, custom, or, an instinctive sixth sense there never is any lack of undertsanding when discussing their own problems in their own peculiar language among themselves. It is only when a foundryman attempts to describe a foundry process to an outsider that he begins to realize how far he has drifted from the instruction instilled in his mind in the far away days of the little red school house.

"The foregoing may be regarded as a little experimental flight and now we find ourselves back where we started. I know that these little blocks of sand I am going to describe are not cores in the proper sense. You know they are not cores, yet they always are referred to as cores in the foundry. To tell you the truth I know of no other name for them and therefore since we all are agreed I think we should be justified in making the thing unanimous. All in favor signify the same by saying 'aye", contrary minded 'no', the ayes seem to have it, the ayes have it, let's go.

"Where duplicate castings are made in large or even in considerable numbers, suitable coreboxes are provided and in that way the molds may be made in one part of the shop and the cores in another in the usual manner. The principal advantage of this method is that the production of molds and cores may go on simultaneously. A sufficient supply of cores for one day's molding requirements is made first and after that, one day's supply is kept ahead automatically. Where only one or two or even a comparatively limited number of castings are required, the expense of making the cores may be reduced to a minimum by employing the pattern itself in the following manner.

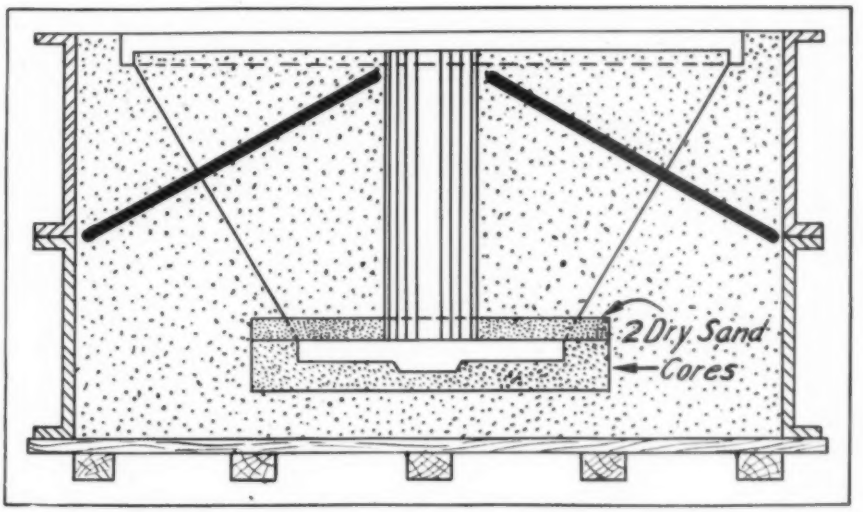
"A square wooden frame approximately 2 inches deep and 2 inches wider than the small base on all four sides, is placed on a core plate either on the floor or on the core oven car. This core is not to be turned over until after it has dried and therefore to save an extra lift it is advisable to make the core directly on the car. Of course this is not always practical since the car may be in the oven or covered with cores waiting to be removed. I only mention this point because it frequently is overlooked and through force of habit many cores are made on the floor and then lifted on to the car where they just as conveniently might have been made directly on the car.

"That part of the pattern containing

the brackets is set in the center of the plate with the lower edge of the brackets, that is the edges designed to rest on the small base, resting on the plate. Core sand strongly reinforced either with rods or an arbor, is rammed between the brackets and out to the edge of the frame. On account of the rigidity obtained, an arbor is to be preferred to rods. The main objection to an arbor in this case is that it must be broken before it can be removed from the casting and therefore a new arbor is required for each core. However, the time required to make an arbor of this kind especially where a bed is maintained on the floor nearly all the time, will not equal the time required to bend and secure a number of rods. The time saved in setting the arbor in the core frame as compared with the time required to set the necessary number of rods far out weighs other factors and renders the method in which the arbor is employed, the more economical of the two. Frequently prejudice and more frequently lack of initiative prevent coremakers from adopting cast iron arbors. However, once converted, these same old hard shells usually are the most enthusiastic supporters of the method.

"After the sand has been rammed it is scraped off approximately flat and then the pattern is rapped and withdrawn. In large cores it may be advisable to provide a few hooks, but usually cores of this character may be handled by hand. The core frame is removed and then the core is ready to be placed in the oven. The frame may be rapped freely before it is removed and therefore it is immaterial whether it is tapered on the inside or not. Where a great many cores are to be made it is advisable to provide a frame with a generous taper allowance so that it will not be necessary to rap it at all. A frame that is rapped a few times is not affected, but a frame that is rapped indefinitely is soon knocked out of shape if not actually ruined.

"The core destined to form the bottom of the small base is formed by placing the base pattern on a flat board, surrounding it with a frame similar to the one already referred to, only that in this instance it is deeper. For example if the base pattern is 2 inches thick it will be necessary to provide a frame about 4 inches deep to insure a 2-inch thickness of sand over the pattern. The thickness naturally will vary according to the area of the core. The frame is filled with sand, rammed, rodded, rolled over and the base pattern removed.



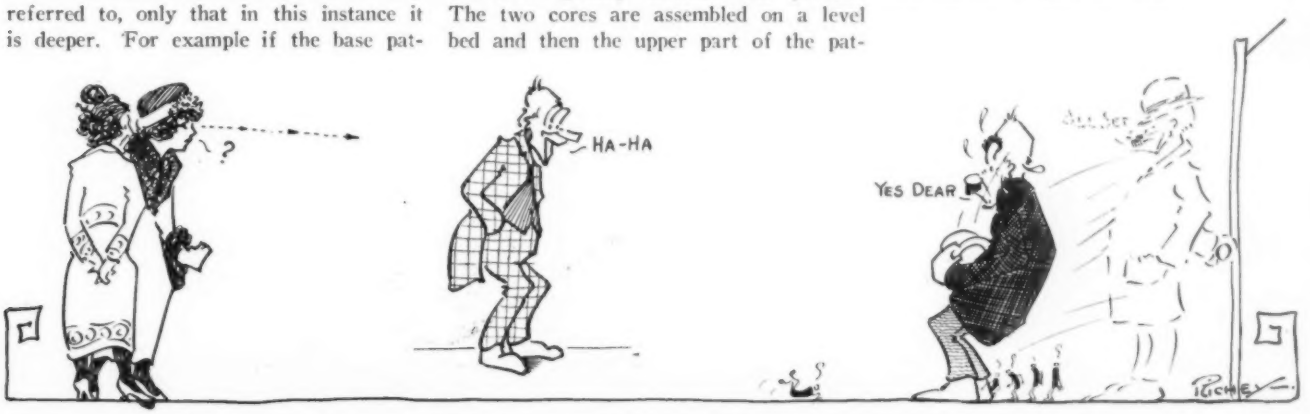
SECTION ACROSS CENTER OF DRAG MOLD WITH PATTERN REMOVED—THE SMALL BASE IS FORMED BETWEEN AN UPPER AND LOWER DRY SAND CORE

"In making the mold, the sand, suitably rodded, is rammed almost to the top of the brackets. The first core then is slipped down over the brackets and adjusted in place. The ends of the brackets serve as a guide and by keeping them flush with the face of the core it is certain that the core is in its proper position. The second core containing the outline of the small base then is set on. The frames employed in making both cores are of the same dimensions and therefore to locate the upper core it only is necessary to see that the outside edges of both cores coincide.

"The remainder of the drag then is filled with sand, rammed and rolled over and the cope may be rammed directly on the drag or on a plain board. If no drag flasks are available or if for any other reason it is either desirable or necessary to bed the pattern in the floor the cores greatly facilitate the process. The two cores are assembled on a level bed and then the upper part of the pattern with bracktes attached is lowered until the ends of the brackets come to rest on the lower core. The pattern then is surrounded with sand rammed in the usual manner. If considered necessary the cores may be split in two for convenience in handling. Whether the rolling over or bedding in method is adopted, the cores produce a good base, free from swells or scabs and is an insurance against any sand falling from the upper side of the base to form an unsightly lump on one side and an equally objectionable cavity on the other side."

If I had been alone I probably should have stayed later, but when I get the high sign I know it is time to quit. I put on the faithful old overcoat and while adjusting what Bill is pleased to call the lid at just the proper angle I asked him if he thought it advisable to print a story on the subjet of column bases.

"Well" said Bill, "I'll tell you. The two easiest things in the world to give and the two most difficult to take are medicine and advice. You have my blessing to go as far as you like, but personally I think you should investigate the merits of pick handles."



THE GOOD OLD SPIRIT IS WILLING BUT THE FLESH IS KIND OF WEAK AT THE KNEES

Tunnel Segments Big Contract

EXCEPTIONAL facilities in manufacturing and handling equipment, as well as a personnel thoroughly trained in quantity production are required for the manufacture of the gray-iron and steel castings for the lining of the Hudson river vehicular tunnel. The magnitude of the work can be realized to some extent from the dimensions of the tunnel, and the amount of material in the lining. The tunnel consists of two similar tubes, one for an eastbound and one for westbound traffic. The length of that part of each of these in which metal lining is used in 6756 feet, or a total of more than 2½ miles. The diameter of each tube is 29 feet 6 inches for the greater part of its length, with a short section slightly larger 30 feet 4 inches to secure greater ventilation on the steepest grade. The total weight of the metal lining is approximately 111,000 tons.

The comparative size of the cross section of this tunnel and that of the first Hudson tunnel, used for electric trains, is indicated by Fig. 2, which shows assembled rings made by Bethlehem Steel Co. for each of these tunnels in its plants at Bethlehem, Pa.

The tunnel lining may be described as a cast metal tube built up of segmental rings, the length of each ring being 30 inches along the axis of the tunnel, and the lining of the two diameters already mentioned.

Each ring of the lining is made of 15 separate segments. As there are approximately 5400 rings in the tunnel, the total number of castings required is approximately 81,000. Of this number, 75,600 will weigh about 1½ tons each, the other 5400 weighing about 800 pounds each.

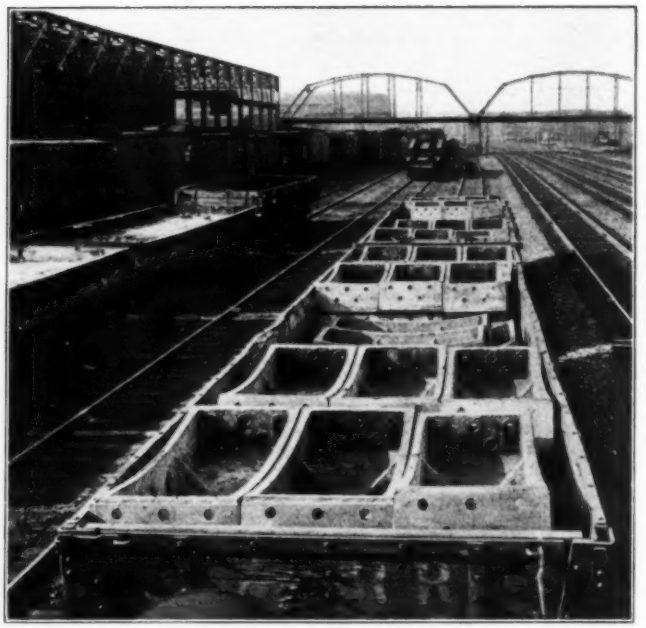


Fig. 1—Two Complete Sections of Segments Are Shipped in a Car

The larger number of the rings have parallel faces, or are straight rings used for straight sections of the tunnel. When a change in line or grade is made in the tunnel, rings with faces at a slight angle to each other are used and are known as taper rings. These are made in two sizes in longitudinal dimensions, namely, 1¼ inches and 2½ inches longer on one side over the nominal length of 30 inches. Fig. 5 shows clearly how the use of these segments of varying dimensions per-

FIG. 2—A SECTION OF THE HUDSON MANHATTAN TUBES 16 FEET 2 INCHES IN DIAMETER, MADE BY THE COMPANY IN 1902, LOOK SMALL COMPARED WITH A SECTION OF THE HUDSON RIVER VEHICULAR TUNNEL, 29 FEET 6 INCHES IN DIAMETER

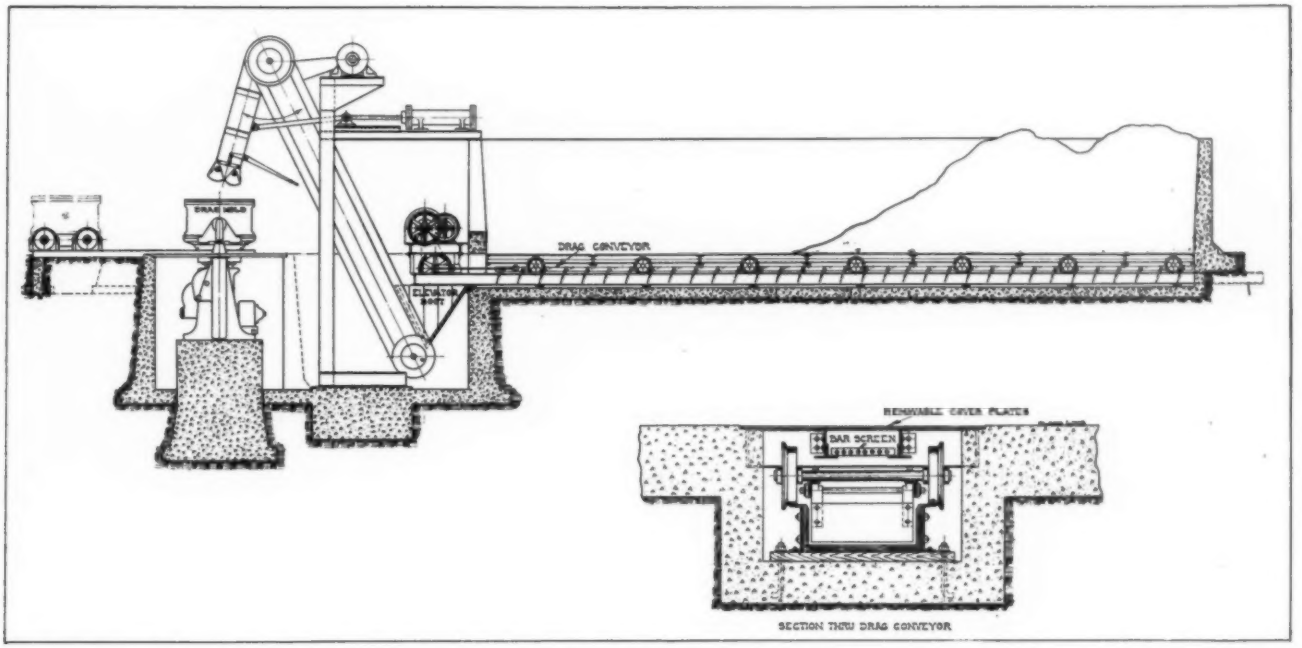


FIG. 3—SAND IS PILED BACK OF THE MACHINE AND AS IT IS NEEDED PLATES OVER THE DRAG CONVEYOR LOCATED IN A PIT, AS SHOWN, ARE REMOVED AND ALLOW THE SAND TO FALL INTO THE CONVEYOR

mits the lining to follow a curve in the tunnel.

In the tunnel excavation the segments of each ring are put in position and bolted together, and the rings likewise are bolted together, the joints being staggered. It is evident that some method of closing each ring from the inside must be provided. To accomplish this, one segment is made small, as previously noted in weights, and this key segment is made with nonradial joints. The ends of the two segments adjoining the key segment, known as *B* segments, have nonradial joints, these forming an opening to permit insertion of the key from the inside of the ring. The other 12 segments of the rings are called *A* segments. They have radial joints and are duplicates of each other. Fig. 4 shows how the segments are assembled to make a ring.

Considering the use of three different segments in each straight ring, and a complete set of patterns for each segment in each of the two sizes of taper rings, the importance of the pattern equipment as a link in quantity production is readily understood. For the 29 foot 6 inch section 57 segment and key patterns are required, with approximately the same number for the 30 foot 4 inch section. The lower insert, Fig 7, which shows a pattern for an *A* segment, straight section, gives a general idea of the pattern used. The patterns for the cast-steel segments are slightly larger to allow for greater shrinkage in casting, and more finish is allowed for machining. The numbering and lettering necessary to facilitate manufacture, inspection and erection of the segments is shown in part by this illustration. This includes the segment number, diameter of tunnel, heat number, trade mark, and in the case of taper segments, the taper size and erection numbers.

Molding sand from a large sand bin is fed by a drag conveyor to a

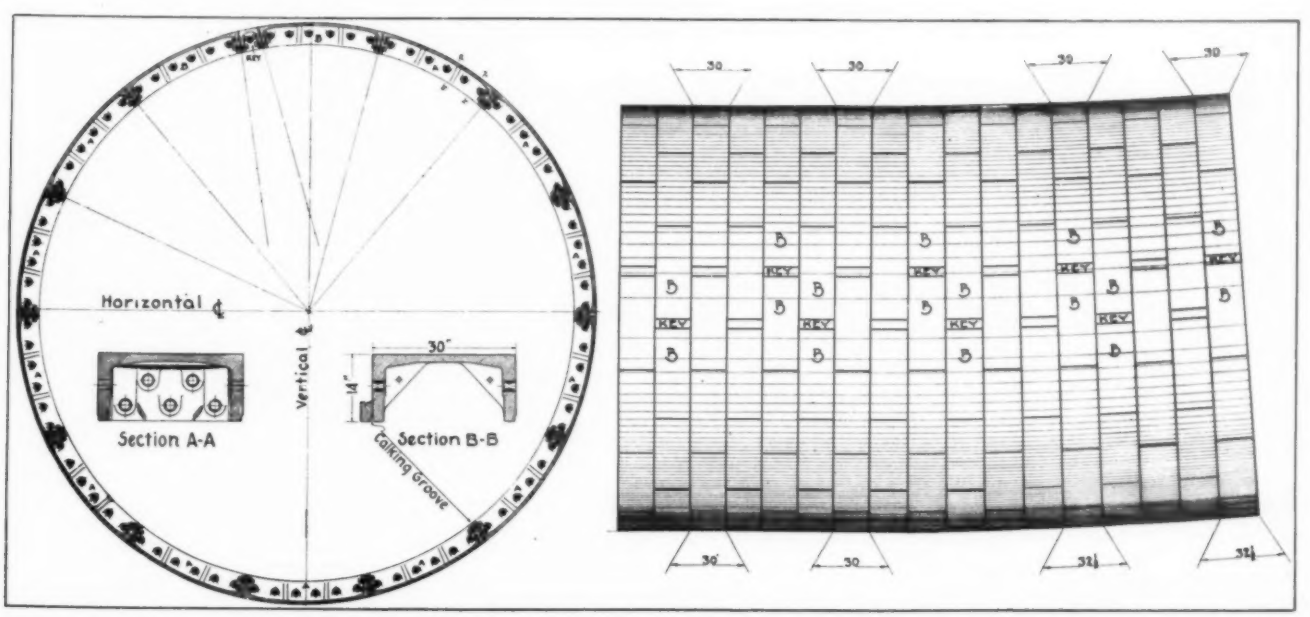


FIG. 4—TYPICAL SECTION OF CAST METAL LINING WITH SECTIONAL DETAILS FIG. 5—KEY SEGMENTS ARE SMALL AND SERVE TO MAINTAIN THE OTHER SEGMENTS IN POSITION

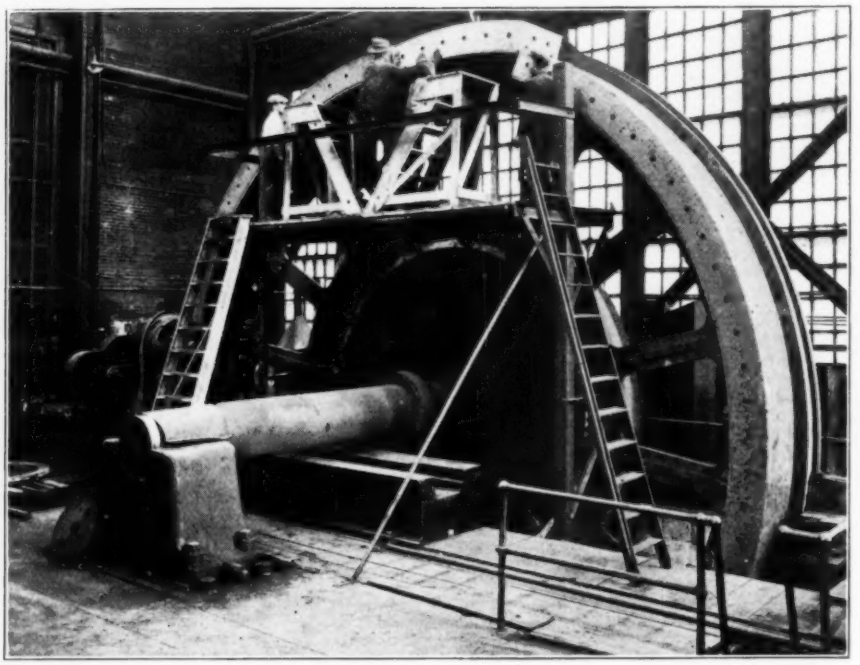


FIG. 6—SEGMENTS ARE CLAMPED TO A SPIDER IN THEIR PROPER ORDER AND PASS A CUTTING HEAD WHICH MACHINES THEM TO SIZE

bucket elevator which carries it overhead and allows it to fall through a chute into the flask. A gate regulates the flow from this reservoir so that flasks are filled rapidly. Jolting by compressed air quickly packs the sand to the proper density. The flask for the drag is lifted and rotated through 180 degrees after which it is deposited upon the run-out car of the molding machine, and the pattern is drawn. The cope is similarly molded on a plain jolt machine. Both cope and drag are transferred simultaneously by crane to the pouring floor.

The making and placing of cores is an important part of finishing the mold. Each segment mold requires 2 end cores, 12 side cores, 4 brace cores and 1 grouting hole core, or a total of 19 cores. These cores must be made and placed accurately, since segments are designed to be interchangeable.

Hot metal from two 84-inch cupolas is taken for pouring the tunnel segments. Each ladle of hot metal will pour three segments. As every ladle is poured an arbitration test bar, 1¼-inch in diameter and 15 inches long, is cast vertically. Sample drillings are taken from the test bars and analyzed for phosphorus and sulphur content after the bars have been tested for transverse strength and deflection.

It readily may be seen that in the interests of economy the handling and transporting of over 80,000 of these heavy castings must be reduced to a minimum. For this reason machines for finishing the ends and side of the segments were installed in adjacent bays in the foundry itself, there being sufficient room in the foundry building

FIG. 7—THE POURING BASIN IS IN ONE END OF THE MOLD — INSERT ABOVE—INSPECTING THE FINISHED SEGMENT — INSERT BELOW—PATTERN SHOWING CORE PRINTS

to allow this without interfering with the foundry operations.

After cleaning and chipping, the segments are segregated as *A* segments, or those with radial ends; *B* segments, or those having one end nonradial; key segments, and 1¼-inch taper and 2½-inch taper segments.

A milling machine was designed and built in the Bethlehem shops for milling two sides of the *A* and *B* segments simultaneously. The segments are loaded two high in fixtures on this machine, located in position by special round headed bolts and held in place by four clamping crabs. Two traveling heads, each equipped with 48-inch cutter heads having inserted roughing and finishing tools, complete the sides to size in one cut, to a tolerance of plus nothing and minus .015 inches in a normal width of 30 inches.

As the traveling heads move from one end to the other, the fixtures with machined segments are removed and replaced with loaded spare fixtures. After the heads have completed their travel, the cutter heads are separated to provide clearance on their return while passing the rough castings that have taken the place of the machined castings. At the end of the return travel of the heads the cutter heads are run in to a fixed stop and the cycle is repeated.

On tapered segments only one side is machined here, the other being machined in a special machine after the segments are bolted in a ring.

From the side milling machine the segments are transferred by a revolving table to the adjacent bay where the ends are machined. In machining the ends the segments are first loaded one high in fixtures on a stationary bed. A traveling head, carrying two cutter heads, completes the machining of the two ends in one operation, and the cycle of operations is performed similarly to the side machining above described. The cutter heads are adjustable and are set at the correct angle to give radial end joints to the *A* segments. When machining *B* segments one cutter head is changed to machine the nonradial end to the correct angle.

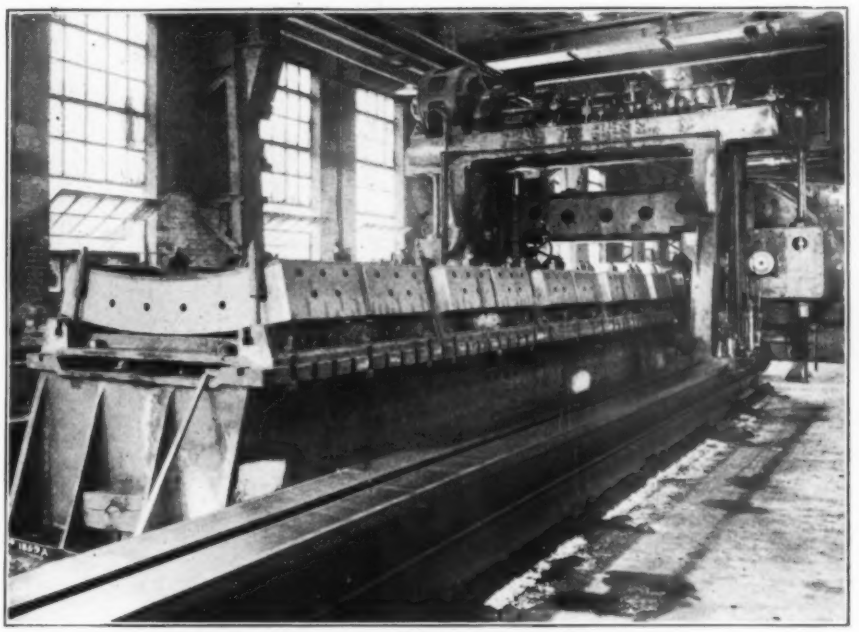


FIG. 8—A TRAVELING HEAD CARRYING TWO CUTTER HEADS COMPLETES THE MACHINING OF THE ENDS IN ONE OPERATION

Segments for the taper rings used on curves and changes of grade have their ends and one side machined as already described. To machine the second side it was necessary to design a special lathe to take care of taper.

The segments are clamped to the spider in their proper order and travel past the cutter head which machines them to size. As the ring of segments revolve, the finished segments come to the top, and are unbolted and lifted out, and unfinished segments are put in their place and bolted. The milling operation is continuous when machining a particular taper.

A careful inspection of all segments is necessary. The width is gaged at each end, and at the center, to a tolerance of 30 inches plus nothing and minus .015 inches. The side holes and angles of ends are checked by templets. The 16 inside bosses for washer seats are tested for parallelism with a plug and collar gage. The brackets are gaged for location and distance, and the bracket holes are gaged with a pin gage.

The segments are then examined for fit of grout plug, size of calking strip, and tarring, and if approved are passed and stamped by inspectors representing the tunnel commission. The finished surfaces then are covered with a coat of white lead and tallow.

Segments forming a ring are kept together for shipment, although all straight segments must be interchangeable. The taper rings are numbered and it is the intention of the contractors to erect them in rings with the segments of the same numbers with which they were machined. Two complete rings, of a total weight of about 42 tons are loaded in a car.

Jolt Machines Mold Segment Castings

CAST iron segments for the New York-New Jersey vehicular tunnel are being molded at the plant of the Bethlehem Steel Co. on two jolt-ram machines furnished by the Osborn Mfg. Co., Cleveland. One of these machines makes the drags and the other the copes. Both are equipped with sand handling apparatus. The machine for making the drag rolls it over upon a run-out carriage operated by an electric motor, then draws the pattern. The cope is made on a plain jolt machine which is set in line with the carriage of the drag machine. This enables the traveling crane, which has two hoists, to pick up a cope and a drag at the same time and carry them to the pouring floor. Pouring begins about two hours after the molding is started in the morning and continues all day. The molds are shaken out at night and the sand is wetted and dropped into a pit where it remains 24 hours.

It is interesting to consider the various detailed steps of the process which will be described, starting with the drag mold. The drag flasks are barred, the same as the cope flasks, and all flasks are machined on both sides so that they are interchangeable and may be piled high on top of one another without danger of tipping over. The flasks are picked up by a crane from piles back of the machines

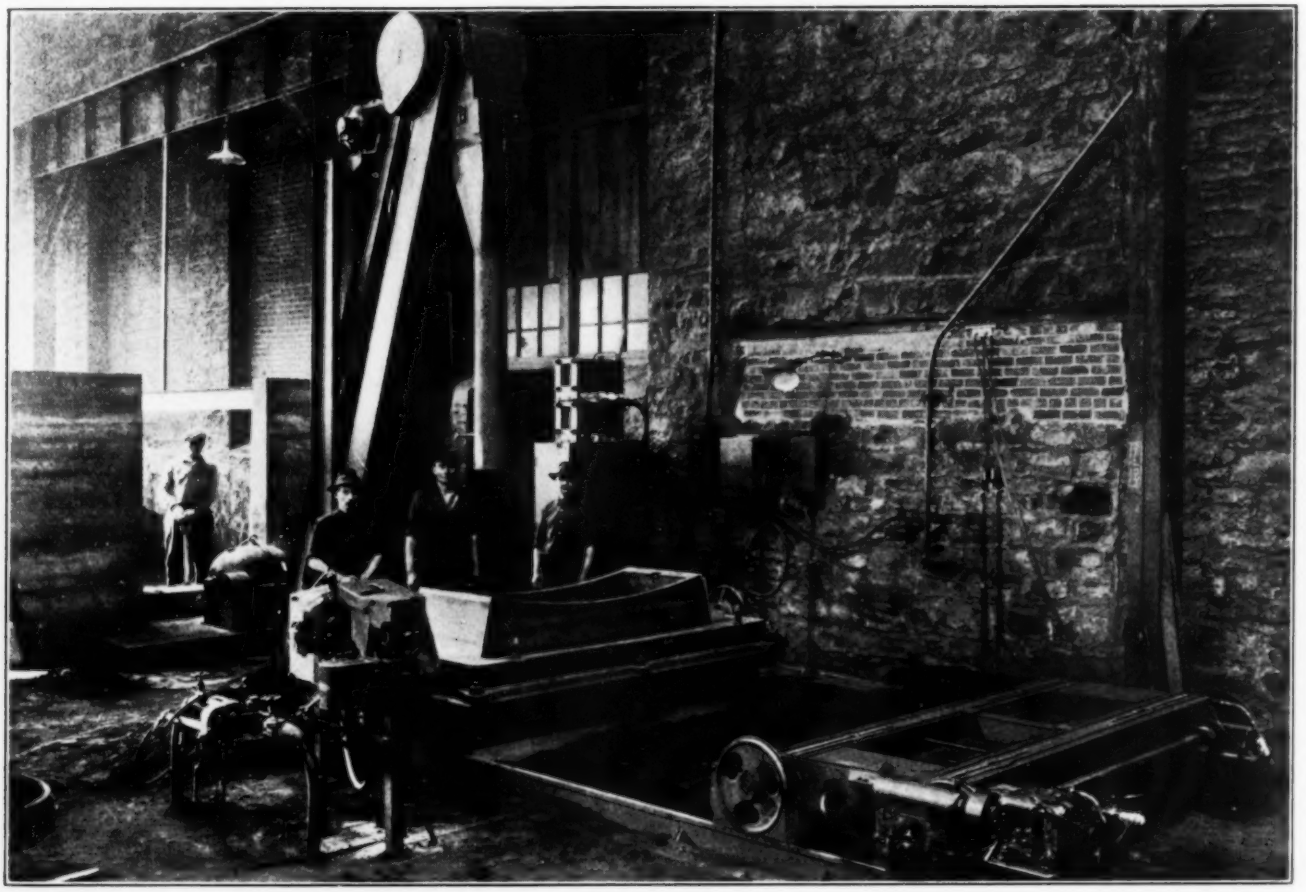


FIG. 1—SAND FOR THE DRAG MOLD IS DELIVERED BY A SAND-FILLING MACHINE AND AFTER THE FLASK IS JOLTED IT IS ROLLED OVER AND SET ON THE ELECTRICALLY DRIVEN RUN-OUT CAR

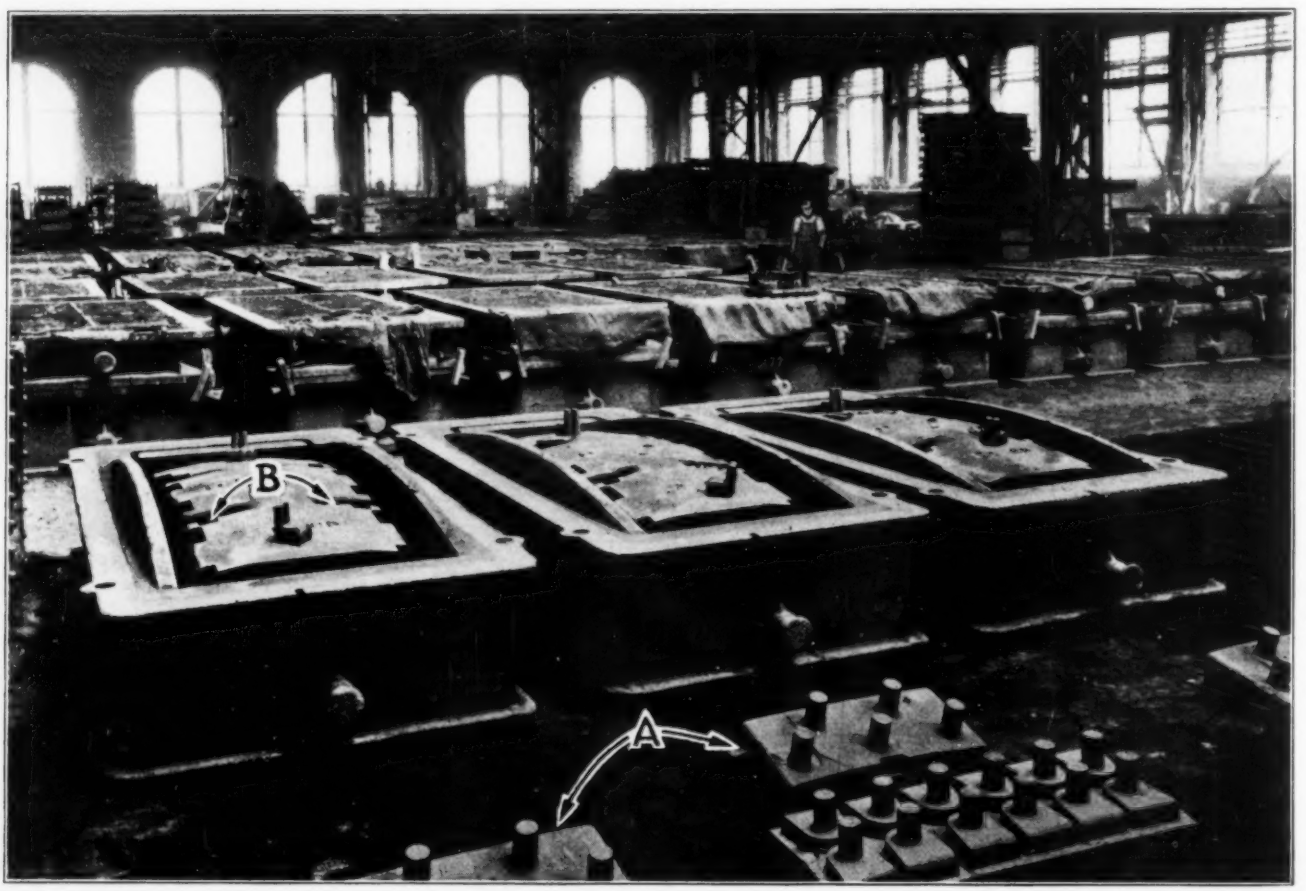


FIG. 2—TWO END CORES FORM FIVE BOLT HOLES EACH, AND 12 SIDE CORES ARE USED TO FORM BOLT HOLES IN THE SIDES—FOUR HOLES IN THE RIBS ALSO ARE FORMED BY CORES

and set on the machines. Before the flask is set on the pattern plate facing sand is thrown in the pattern and pushed against the inside walls. This is necessary because the molding sand, even though allowed to lay in a pit 24 hours after being used is so warm that it might stick to the pattern if allowed to lie against the wall. A number of different patterns are used, but the angle on the side which fits into the patern board is the same in each case so the same pattern board can be used for each pattern. The pattern board is cast iron, while the drag patterns are wood.

The flask is located by four dowel pins on the pattern plate. These dowel pins extend through the flange of the flask, and are slotted so that the flask can be held to the table of the machine by driving drift wedges through the slots.

Introduced from a Hopper

Sand then is introduced from a hopper or bucket above the flask. Formerly equipment as shown in Fig. 1 was used, and this equipment is used now for the cope. It consists of an elevating conveyor which raises the sand from a concrete pit, which is described later in considering the sand handling equipment, and falls through the chute shown hanging in front of the elevator. While this works satisfactorily for the cope which does not require as much sand as the drag, a few seconds are lost in filling the drag when this method is used. Therefore a bucket, with two flat gates forming the entire bottom of it, was substituted for the chute in the drag machine. This bucket which holds just enough sand for filling the flask is filled while the mold is being jolted and rolled over, and the two gates allow it to be instantaneously discharged, so a few seconds are gained in making every drag when this method is employed.

After the sand is delivered to the flask it is jolted 25 times, the machine stopping automatically when the required number of jolts have been given. The sand is then rammed between the bars with the butt end of a pneumatic rammer and struck off. Next the flask is raised and turned over. While the table of the machine is being raised, turned, and lowered, the run-out car is brought under the table to receive the mold. This car, which has a table 110 inches long over all, corresponding to the table of the machine, is operated by an electric motor shown at the right end, Fig. 1. The power is carried by a cable which lies on the ground under the car, and its operation is controlled by a switch located near another switch which controls the operation of the rollover and jolt operations. This control system may be seen at the left of the machine in Fig. 1. While the car is operated by a 20-horsepower electric motor the rollover and draw operations receive their power from compressed air.

Flasks Held Level

When the machine brings the flask down on the table of the run-out car the flask is held perfectly level and strikes two bars on the car, which may be seen extending across the top from wheel to wheel. Each of these bars is held by a pointed piston operating in a cylinder, and backed by oil. As the flask comes down on the bars they are depressed about an inch and held level by the pressure of the flask, which in turn is held in a level position by the plate of the machine to which it is attached. After the rods are depressed about an inch, the table of the machine is brought to rest and the oil in each of the cylinders is shut off, thus locking the pistons in the position in which they have been forced by the down coming flask. The oil to each cylinder is controlled by a separate valve, therefore the cylinders are independent of each other. Now, with each cylinder locked,

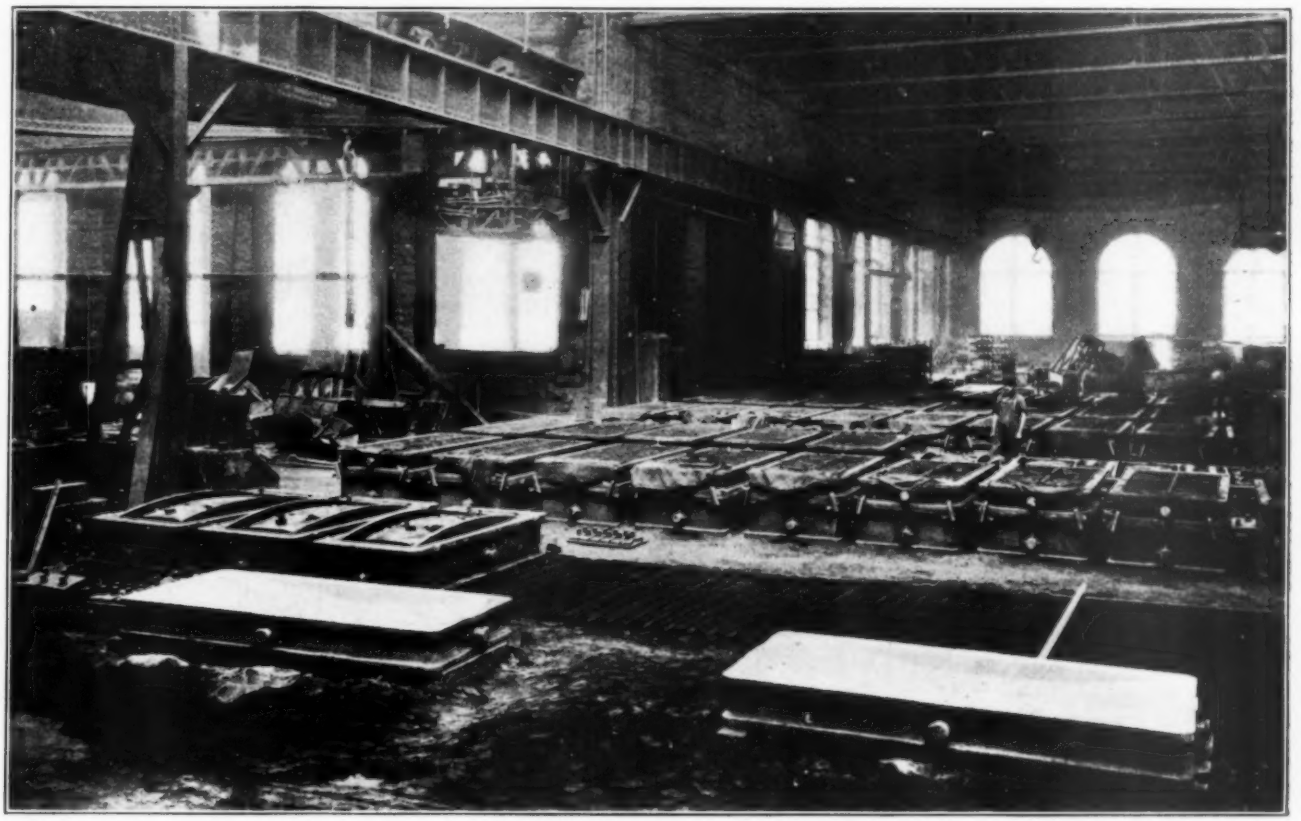


FIG. 3—DRAGS ARE SET ON LEVEL BED MADE OF GREEN SAND—VENTS ARE FORMED BY THE STRIKE-OFF WHICH IS PRESSED IN THE SAND ACROSS THE BED AT REGULAR INTERVALS

the flask is held in the same position after the drift wedges are knocked out and it is allowed to rest on the cross bars instead of being held by the plate of the machine. The cross bars of the flasks all have been machined so that their edges are slightly below the face of the flange of the flask. Thus no portion of the flask touches the supporting bars except the flange face.

After the flask is freed from the table of the machine by knocking out the drift pins which were holding it, the lever to raise the machine is opened. This automatically starts the vibrator which continues operation until the pattern is drawn to a predetermined height when it is again shut off. After the pattern is drawn the run-out car carrying the mold is moved to the end of the track.

While the drag is being made the cope is molded on a plain jolt machine. This machine, which has a lifting capacity of 12,000 pounds and a table 42 x 97 inches, sits parallel to the drag machine with the table on a line with the run-out car when it is at the end of its track. The pattern is metal and is attached directly to the table of the machine which acts as pattern plate. The flasks are attached to the table as described for the drag. However, the cope is jolted only 20 times instead of 25 times as is the case with the drag. After the mold is finished and the sand struck off, being in line with the drag mold, the two molds are lifted at the same time by the bridge crane having two trolleys and the molds are carried to the pouring floor. The drag-molds are set in a line on a bed of green sand which has been leveled by a strike-off stick and ridged with lines by pressing the strike-off stick across its face. The depressions made by the stick serve as vents with terminals at each side of the flask. Three of the drag flasks may be seen at the left, Fig. 3, which also shows the bed prepared for more molds.

Time Study of Molding Drag

Clean pattern	Only cleaned every 15 to 20 molds.		
Place parting	Placed while machine is rolling back.		
Place facing	10 seconds	12 seconds	
Place flask	15 seconds	10 seconds	
Clamp flask	6 seconds	3 seconds	
Fill with sand	25-50 seconds	25-40 seconds	Total is level off
Jolt 25 times	15 seconds	14 seconds	
Butt off	40-45 seconds	50-55 seconds	First is butt and total is strike off
Roll over	20 seconds	15 seconds	
Run under level car	3 seconds	.. seconds	While machine rolls
Lower	5 seconds	6 seconds	
Unclamp	2 seconds	4 seconds	
Draw pattern	10 seconds	11 seconds	
Run out car	3 seconds	4 seconds	
Roll table back	17 seconds	16 seconds	
Total	3 minutes 22 seconds	3 minutes 10 seconds	

Pouring Basin at One End

As shown in Fig. 3, the copes are turned by the crane and set on blocks to be slicked and finished. The two copes in the foreground are ready to be closed on the drags. The pouring basin, with a down gate at each side of it, is located at one end of the cope. The flasks are set in two rows with the pouring ends away from each other. In this way no aisle is needed between the two, which are set close together. As indicated in Fig. 3 a pouring aisle is left between each double row of flasks.

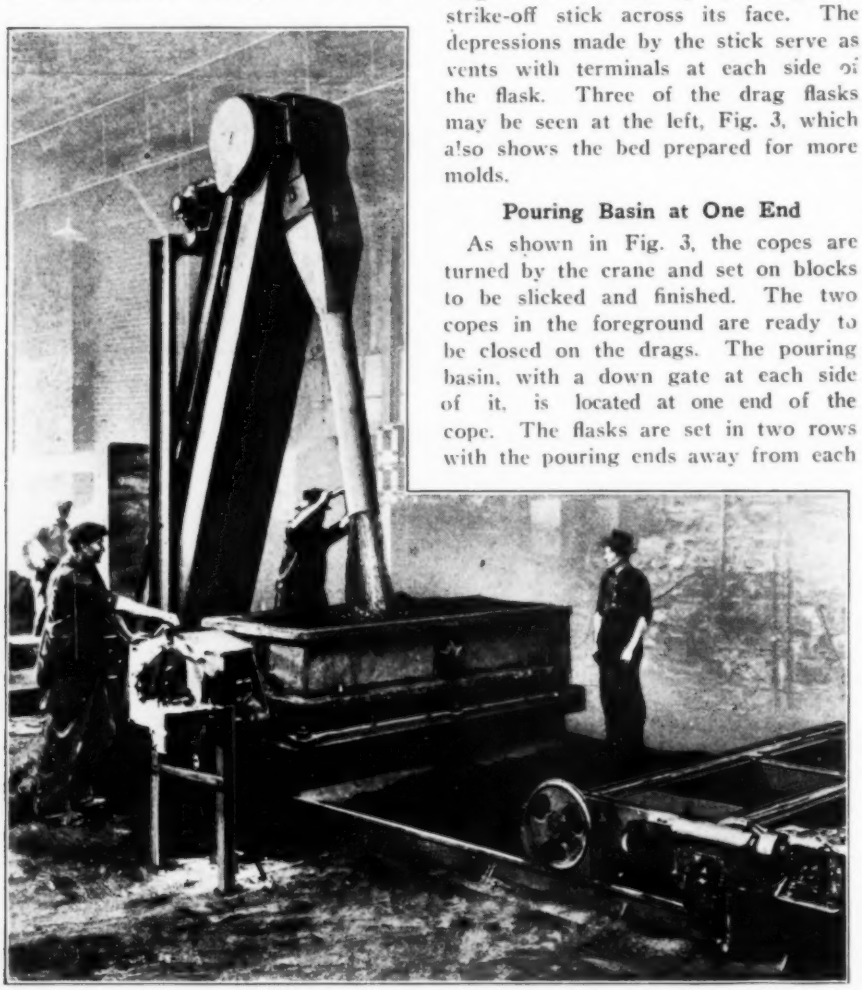


FIG. 4—THE FLASK IS QUICKLY FILLED WITH SAND BY OPENING A GATE

Besides the molds a number of cores are required. The two end slabs form the sloping ends of the segment, the pattern being filled at the ends to allow it to be drawn. Each of these cores also forms five bolt holes, as is indicated by the two cores shown at *A*, Fig. 2. Twelve more cores are needed to form bolt holes in the sides of the casting. These cores are shown on a plate at the right in Fig. 2. The four ribs extending from the sides of the castings each require a core. These cores are shown on the drag molds in Fig. 2; two of the ribs are clearly indicated in the mold at the left, at *B*. An ingenious core forms the threads for a 2-inch pipe used to connect the cement gun when the segment is set in the tunnel. This is made in a split core with a one-piece round section for forming the thread which would have a fin were it formed by the split box. The corebox is set on end for filling with sand and after the sand has been rammed and struck off the threaded section of the corebox is screwed off. Then the split box is withdrawn by pulling it apart, and the core, which is made with an oil binder, is transferred at the drier plate ready to be put in the drying oven. The side cores are made on a rollover machine and the end cores on a direct-draw rollover jolt machine. These machines also were furnished by the Osborn Mfg. Co.

Castings Shaken Out at Night

As has been said, the pouring starts about two hours after the molding begins in the morning. The metal is brought to the floor in ladles carried by industrial cars and is poured by the crane at the end of the floor. The molds are not shaken out until night. Then the crane carries the

molds to the machine which makes the copes. For shaking out this is fitted with a flask from which the entire end, with the exception of the upper flange and a small section underneath it, has been cut. A baffle plate also has been bolted to the inside of the flask extending diagonally through the flask from the top at the one end to the bottom at the end from which the lower section has been cut. The pins by which the cope flasks are held also serve to anchor the shake-out flask.

The crane sets three cope flasks or one drag flask on the shake-out flask which is jarred and drops the sand on the baffle plate. Here it slides down the incline formed by the plate into a pit in front of the machine where it is wetted and allowed to remain until the next night. Then it is picked up by a grab bucket and dumped into the concrete bin back of the machine when it is again wetted. A conveyor is located in a depression the full length of the bin. This depression is covered with steel plates to prevent the sand from falling into the conveyor. Then when sand is wanted the plates are removed, one at a time as the sand is needed, and the sand falls into the conveyor and is carried into a boot, or pocket at the base of the elevating conveyor of the flask-filling machine.

After the flasks are shaken out they are piled behind the machine ready for use the following day. About 10 per cent new sand is added to the old sand as it is thrown into the bin back of the cope machine, but no new sand is added to the backing sand used in the drag. The facing sand for the drag is prepared between the two machines by riddling through a gyratory riddle supplied by the Great Western Mfg. Co., Leavenworth, Kans. No facing sand is used on the cope.

The immensity of this job is not appreciated from a qualitative description, but when it is considered quantitatively the enormous amount of work being done by this equipment is more readily appreciated. From 130 to 140 complete molds are turned out in a day of 10 hours, each machine making the requisite number of either drags or copes. As each casting weighs 3250 pounds the day's output requires approximately 230 tons of metal. Even more sand than metal is required, the drags using 294 tons and the copes 140 tons. This must be carried from the machine pit to the mold, jolted in the mold 20 to 25 times, then carried to the pouring floor where the cope must be handled twice. After the metal is poured, the sand for the next day must be removed from the shake-out pit and carried to the pits of the machines. Then the flasks must be shaken out and piled and the castings sent to the cleaning department.

One of the most remarkable features about the operation is the comparatively small number of workmen needed to carry out the operations. A total of only 20 operators is required. One is on each of the three cranes which handle the molds and pour the metal. Six workmen are on the floor making the beds, setting the cores, finishing the copes, patching the drags, and closing and pouring the molds. One is located in the sand pit of each machine to remove the steel plates over the conveyors and keep the sand feeding regularly. A gang of four workmen is provided for each machine. The leaders of each gang operate the machines and the leader of the gang on the drag machine sets the pace, for the entire job, as the work on the cope is slightly less than that on the drag and work does not go any faster than the drag can be made. One workman prepares the facing sand for the drag. At night a separate gang shakes out and prepares the flasks and sand for the following day's operation.

The speed with which the individual operations are performed may be judged from the results of time studies made on the work. Two of these are shown in the accompanying table. The pattern is cleaned only after every 15 or 20 molds so this time is not recorded in the study. Under the heading, "Fill with sand," two figures are given in each case. The 25 seconds are required to drop the sand into the flask and the second figure includes both the time required to drop the sand into the flask and that used in leveling it off. In butting off one workman uses the pneumatic rammer to ram the sand between the bar and two others strike it off. The first figure under "Butt Off" is the time used in ramming, and the extra time shown by the second figure includes the time spent in finishing the striking off of the sand after the butting-off.

Securing Information on Cupola Practice

Question—In an editorial on "Cupola Practice Not Standardized" in a recent issue of THE FOUNDRY, you state that information on cupola melting methods is on record and is available for a minimum of time and trouble to any person interested. Will you be good enough to advise me where this information may be obtained.

Answer: We regret if we conveyed the impression that all information practically is free or that it may be had simply on request. A considerable volume is absolutely free, for example, the J. W. Paxson Co., Philadelphia, has published a bulletin on the subject that may be had for the asking. The Whiting Corp., Harvey, Ill., has available literature along the same line. THE FOUNDRY published no less than 35 articles on cupola practice in 1922, many in the form of specific answers to questions inspired by troubles experienced by readers.

We do not know just how familiar you are with the subject, that is whether you want to start at the beginning and learn the elementary features or if perhaps you only require information on the more advanced theoretical phases. For a comprehensive study of the subject we should suggest that you secure a copy of *American Foundry Practice*, by West and *Principles of Iron Founding*, by Moldenke. These books may be ordered from the Penton Publishing Co., Cleveland. Probably the most complete and practical treatise on modern cupola practice is that compiled and issued by McLain's System, Goldsmith building, Milwaukee.

Cast Carborundum on Face of Step Plate

By August M. Roth

Casting carborundum on the face of gray-iron step plates is an operation comparatively simple if all the essential points are known and followed. A short while ago we received an order for some step plates to have carborundum cast in the face. This was not an easy job until we mastered all the details necessary to make the operation successful.

We found that the mold first should be made in the regular way and the pattern lifted out, after taking off the cope. The face of the mold then is sprayed with a solution of silicate of soda, or *water glass*, in about six parts of water. After sprinkling the surface of the drag mold with carborundum the pattern is put back and tapped thoroughly to squeeze the carborundum into the sand. If the section of the pattern is thick, large crystals of carborundum may be used, but if the section is thin, finer crystals must be taken, or they will not adhere to the iron of the casting. When the pattern is removed the surface of the mold again is sprayed with sodium silicate. Then the surface of the mold is dried with an oil torch, just enough so that the sodium silicate forms a surface over the carborundum. The surface is allowed to cool before some powdered fluorspar is sprinkled over it. This, with the sodium silicate, forms a flux which washes over the carborundum.

The mold is gated so that the metal will run over the full length of the face of the mold to an overflow head. The main essential with the metal is that it be hot.

The writer has had success in casting plates 5 x 5 feet x ⅜ inch thick.

Southern Metal Trades Elects Officers

New officers to serve during the ensuing year have been elected by the Southern Metal Trades association as follows: President, J. R. Hedges, Casey-Hedges Co., Chattanooga, Tenn.; first vice president, E. F. Billington, Soule Steam Feed Works, Meridian, Miss.; treasurer, J. M. Hollowell, Spaulding Foundry Co., Atlanta, Ga.; secretary, W. E. Dunn Jr., Atlanta, Ga. The following administrative councillors, representing the various states through which the association extends, were elected: W. S. Pfohl, Briggs Shaffner Co., Winston Salem, N. C.; T. H. Siddall, Sumter Machinery Co., Sumter, S. C.; John S. Schofield, Schofield Iron Works, Macon, Ga.; R. O. Collins, Tallahassee Iron Works, Tallahassee, Fla.; E. W. McDonald, Talladega Foundry & Machine Co., Talladega, Ala.; J. A. Mosal, Mississippi Foundry & Machine Co., Jackson, Miss.; T. L. LaMalta, Chickasaw Machine & Foundry Co., Memphis, Tenn.; F. I. Brown, Arkansas Foundry Co., Little Rock, Ark.; Chas. R. Law, DeSota Foundry & Machine Co., Mansfield, La.; W. C. Trout, Lufkin Foundry & Machine Co., Lufkin, Texas; W. E. Thomas, Union Foundry Co., Danville, Va.

How and Why in Brass Founding

By Charles Vickers

Small Gates and Cold Metal Responsible

We experience trouble in making small but massive castings where dross and holes appear in the castings after they are machined. We are using a mixture of copper 90 per cent; tin 7 per cent; zinc 2 per cent and lead 1 per cent. We place 3 ounces of 15 per cent phosphor-copper in a bed of charcoal in the bottom of the crucible. We melt in a No. 150 tilting furnace using natural gas and pour the metal at a temperature of 2080 degrees Fahr.

An inspection of the sample casting inclines us to the belief that the gates are too small and the metal poured too cold. We suggested pouring the molds with metal at least 100 degrees hotter than stated. Also cut the gates deeper. It would be advisable to use *set* gates of white metal to avoid the extra work of cutting the gates on each mold and also to insure gates of uniform size. Should these changes fail to correct the trouble, mold the curved surface in the cope part, use a gate twice the area of the one you are using at present and pour the casting with hotter metal.

Phosphorus To Be Dried Before Immersion

A problem of getting a considerable content of phosphorus into lead or antimony and into babbitt metal consisting of lead, antimony and a small amount of tin has been presented to us. We would like to know the saturation point of phosphorus in these metals, and a good way to handle it. The use of an ordinary inverted bell graphite phosphorizer is attended with considerable danger, not so much from the phosphorus itself, but to the difficulty of drying it. The phosphorus has to be kept under water and when a phosphorizer charged with wet phosphorus is immersed in metal, the steam generated will blow part of the metal out of the melting vessel.

We are unable to give the saturation point of phosphorus in antimony, lead or babbit metal. The highest alloy with tin obtainable at atmospheric pressure has been ascertained by A. C. Vivian to be 8.5 per cent phosphorus. The standard phosphor tin on the market contains 5 per cent phosphorus. When the phospohrus is added to the antimony, lead or babbitt metal. The highest alloy a phosphorizer there is no question but that the chemical must be dried. The best way to dry it is to immerse the cakes of phosphorus (stick phosphorus is unsuited) in clean water kept in an earthern crock. Dissolve a quantity of copper sulphate in the water and allow the phosphorus to remain in the solution until plated with copper, then remove before the copper peels. The copper plated cakes will not inflame if out of the water for probably 6 hours. They can be dried with blotting paper or some other absorbent material, but the cakes must not be rubbed. If the water is removed and the cakes allowed to dry, they can be packed in the phosphorizer and the latter used without danger from water. However, it is advisable to do the alloying while the vessel of tin or other metal is in a safe place, so that if metal flies it will do no harm.

Core Mixture Produces Rough Surface

We are making small valves and find difficulty getting the inside sufficiently smooth to enable them to be assembled with the minimum amount of finishing. The cores are well made but leave the casting with a rough and file-like surface. We send some castings for your inspection. One part molding sand to 12 parts silica sand with molasses as a binder is used in making the cores. Can you suggest a better mixture?

The difficulty is caused by the addition of too large a percentage of sharp sand. Compare the inside of the castings with the outside surface. The latter is smooth and free from the little protuberances which make the inside feel like a rough file. The outside was made in molding sand entirely. Evidently if the core could be made entirely of molding sand the inside surface would be as smooth as the outside which is smooth enough for any purpose. A core made entirely of molding sand would not be sufficiently porous to permit escape of gases. The cores would blow if sharp sand were not added to create a more permeable structure. It will be advisable to experiment with larger amounts of molding sand in the core mixture. The following mixture which has been used with success in some localities is given as a guide: Molding sand, one part; sllica or other sharp sand, 2 parts; mix and add 1 quart of good core oil to 60 parts sand and temper with molasses water. These proportions can be modified to suit the sand being used. It is because of the difference in sands found in different localities that mixtures for cores vary. Thus, sands like Providence river sand can be used to make cores that produce a casting as smooth as produced by cores of all molding sand and nevertheless are so porous the breath can be blown through them. Such a sand makes ideal cores but would be too costly to use in parts remote from its origin. A little experimental work along the cut-and-try line will solve the problem of getting a core that will leave a smooth surface in the casting.

SAFETY CODE FOR FOUNDRY WORKERS

(*Continued from Data Sheet No.* 470)

Rule 112. *Floor Adjoining Tracks*—The floor immediately adjoining industrial tracks over which workmen frequently pass shall be reasonably hard and flush with the top of the rails. Sufficient clearance for easy passage of truck wheels shall be provided between floor and rails.

Rule 113. *Pits*—All pits or openings located in foundry floors shall be guarded by suitable coverings or railings where practical; where impractical a watchman should be provided.

Rule 114. *Galleries*—Galleries where molten metal is poured into molds shall be provided with a solid partition of fire-resisting material not less than 3 feet 6 inches high, installed on open side of such gallery.

Section 12. Gangways

Rule 120. *Definitions*—The term "gangway" shall mean a well-defined passageway dividing the working floors of a foundry.

The width of a gangway shall be understood to be the clear distance between molds, posts, partitions or other obstructions on one side of the gangway and similar objects on the other side.

Rule 121.—*General Gangways*—Gangways other than those for carrying molten metal shall be of sufficient width to allow the passage of employes and materials, and shall be illuminated in accordance with the requirements of the Factory Lighting Code.

Rule 122. *Condition*—Every gangway in which molten metal is being handled shall, during the progress of pouring, be kept in good condition, clear of obstructions and free from undue dampness.

(*Continued on Data Sheet No.* 472)

SAFETY CODE FOR FOUNDRY WORKERS

(*Continued from Data Sheet No.* 471)

Rule 123. *For Crane, Trolley or Sulky Ladles*—Gangways where molten metal is carried in crane, trolley or sulky ladles shall be sufficiently wide to allow employes safely to handle and empty the ladles.

Rule 124. *For Truck Ladles*—Gangways where molten metal is carried in truck ladles exclusively shall be not less than 18 inches wider than the extreme width of the truck ladle.

Rule 125. *For Crucibles*—Gangways where molten metal is carried in crucibles by not more than two men per crucible and poured into molds placed on one or both sides of the gangway shall be not less than 3 feet wide.

Rule 126. *For Crucibles*—Gangways where molten metal is carried in crucibles by more than two men per crucible and poured into molds placed on one or both sides of the gangway shall be not less than 4 feet wide.

Rule 127. *For Hand or Bull Ladles*—Gangways where molten metal is carried in hand or bull ladles by not more than two men per ladle and poured into molds placed on only one side of the gangway shall be not less than 3 feet wide.

Rule 128. *For Hand or Bull Ladles*—Gangways where molten metal is carried in hand or bull ladles by not more than two men per ladle and poured into molds placed on *both* sides of the gangway shall be not less than 4 feet wide.

Rule 129. *For Hand or Bull Ladles*—Gangways where molten metal is carried in hand or bull ladles by more than two men per ladle shall be not less than 5 feet wide.

Section 13. Aisles

Rule 130. *Definitions*—The term "aisle" shall mean a passageway between molds leading from the gangway.

The width of an aisle shall be understood to be the clear distance between molds,

(*Continued on Data Sheet No.* 473)

THE FOUNDRY DATA SHEET, APRIL 1, 1923
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Operating Wilson Foundry-II

Producing Cylinder Cores for Knight Motors—Ground True in Fixtures—Six Cylinder Job Presents Interesting Details—Cores Sent to Foundry Ready for Use Are Set with Jigs

BY D. R. WILSON

DETAILS of the production of cylinder cores for the Knight motor are of interest. Fig. 1 shows the slab-core grinding fixture. This fixture is a tool-room job with stops for locating the core accurately. The jig is mounted on a carriage, which runs on the rolls shown, so that it easily can be passed under the disk wheel.

A view of one end of the assembly line up with some of the preliminary operations is shown in Fig. 2. The girl in the foreground is jointing a jacket core. These jointing jigs have hardened steel guide faces, which are made as hard as possible. After the core is placed in the jig a sanding block is first passed over it to rough off the first of the sand, and then the hardened steel square bar, as shown, is used for forming a perfect joint. Fig. 3 shows the pasting jigs used for holding the cores in position while the paste is being dried. At the left a partially assembled core is shown with the upper cover core taken off and set on top of the barrels so as to show its general form.

Fig. 6 shows the workman assembling cores and placing them in the pasting jig. The man at the right is just placing the

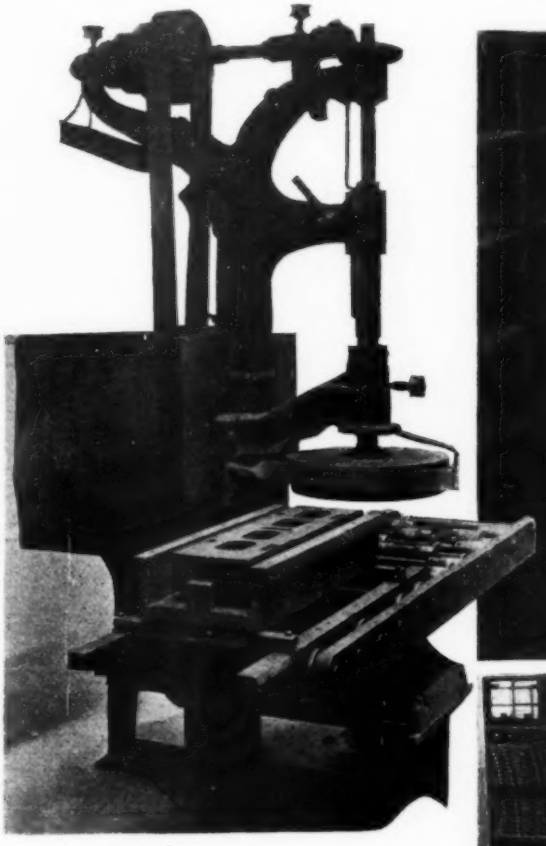


FIG. 1—ABOVE—MACHINE GRINDS SLAB CORES TO SIZE FIG. 2—ABOVE AT RIGHT—JOINTING JACKET CORES—FIG. 3—AT RIGHT—CLAMPING JIGS FOR DRYING PASTED CORES

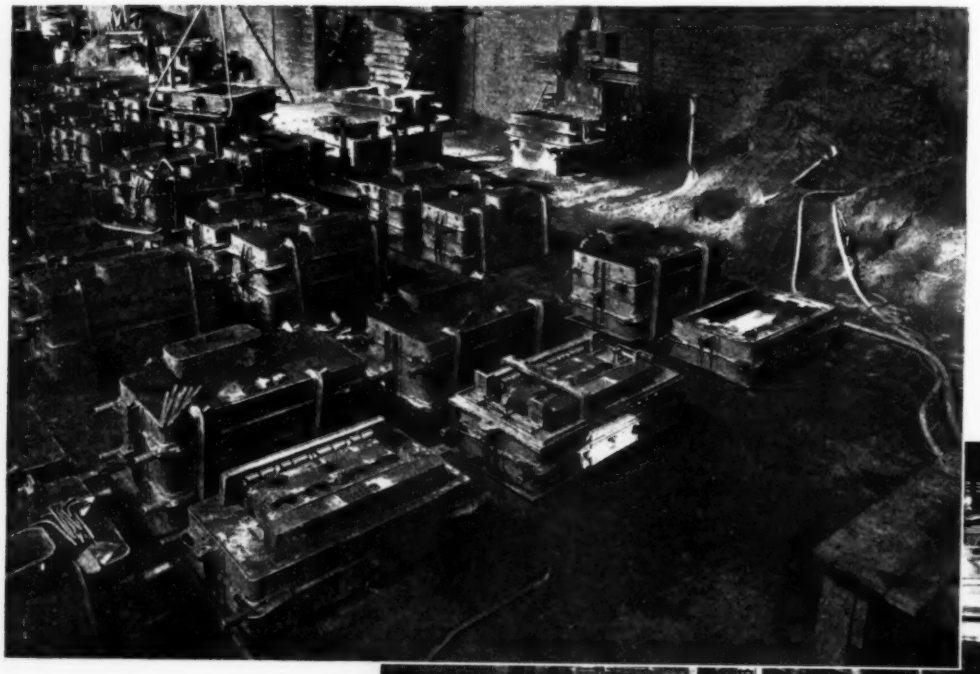


FIG. 6—BELOW—PROGRESSIVE ASSEMBLY AND REAMING JIG FOR KNIGHT MOTOR CYLINDER CASTINGS

FIG. 4—ABOVE—CORE SETTING JIGS FOR KNIGHT MOTOR CYLINDERS FIG. 5—BELOW—VIEW OF KNIGHT CYLINDER MOLDING FLOOR SHOWING CORE SETTING ARRANGEMENTS

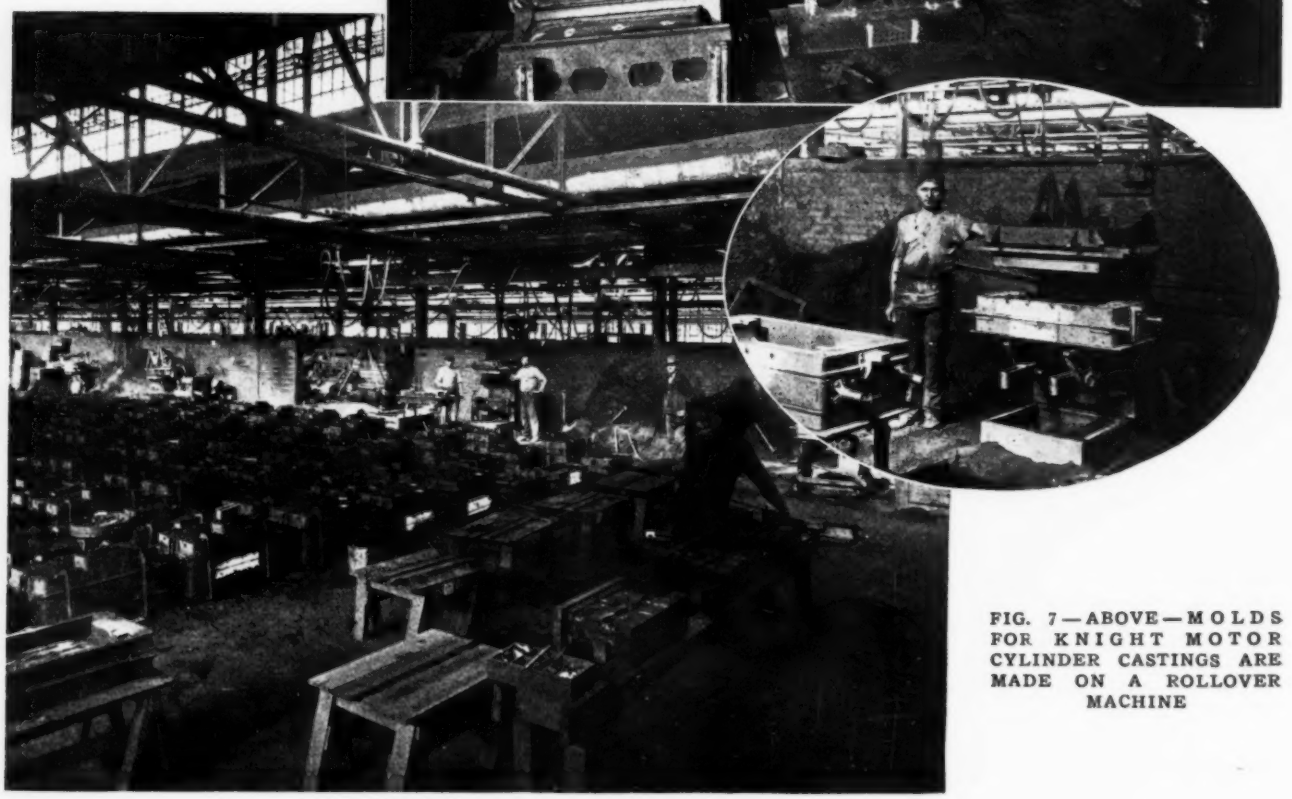


FIG. 7—ABOVE—MOLDS FOR KNIGHT MOTOR CYLINDER CASTINGS ARE MADE ON A ROLLOVER MACHINE

top cover core, and the man at the left is pasting a long half-sleeve core in position. This half-sleeve core is pasted and then luted to close the joint.

Back of the workman in Fig. 6 may be seen the general lineup. The cores start at the further end of the gravity carrier and move toward the front. The jacket cores are first cleaned, jointed and pasted, and then placed on the shelves at the right, held in position by clamps, and allowed to dry 24 hours. They are subsequently put into the reaming jig which the first girl is operating. This reaming jig has locating pins on the outsde, and statonary spindles to guide the reaming fixture through the openings surrounding the barrels. The reamer consists of a hollow tube or pipe which guides over the stationary pins, and which is surrounded by sanding blocks adjusted accurately to the diameter required. The girl twists this reamer down through each barrel of the jacket, and then the assembled reamed jacket is passed forward to the men who make the final core assembly and clamp the same in the paste drying jig. These assembled cores are placed on racks to go to the core oven while the dried assemblies taken from the fixtures are placed on the second line of gravity carriers which runs down beyond the workman shown in the foreground. They are unloaded from this carrier to the racks which take them to the foundry.

The entire core assembly for this job is jig assembled and sent to the foundry in the jig frame ready to be set in the mold. All paste drying jigs and all other pasting jigs for use in connection with core work are carefully machined so that each is an exact duplicate of any other, and this assures accurate work in connection with the cores. At the bottom of the core assembly in front of the man at the right, Fig. 6, may be seen the strainer gate core through which the cylinder is poured.

The molding machines for producing molds for this job are shown in Fig. 7. They are of the rollover type made by the Grimes Molding Machine Co. A half mold is shown run forward on the car.

Cores Carefully Inspected

A general view of the molding floor and machines is shown in Fig. 5. In the foreground may be seen several of the assembled cores as received from the core room. These are carefully inspected, and the guide wedges are taken out, after which the cores are made ready for setting. A close-up detail of the core setting and jigging can be seen in Fig. 4. At the right a drag is shown in place ready to receive the core assembly. Next to this is a mold with the core assembly in place, and the core gaging fixture placed over the drag, being located by the flask pins. Next to this may be seen a mold with the core set ready for closing on the cope. The sprue in the top of the cope is closed with a piece of tin having a piece of tissue paper laid over it. The runner box ring is then placed in position and the runner is formed, as may be seen on the other molds. The mold is then clamped and is ready for pouring. Over the floor an air hoist is shown supporting a half mold by means of a special pair of tongs, this mold having just been lifted from one of the machines.

Fig. 5 shows the work tables upon which the half molds are set for inspection and preparation. All cores come to the foundry ready for use, and no molder is allowed to do any filing or rubbing of a core. If by chance any core does not fit it must be returned to the core room, but with the system of jigging and testing cores it is rare that a misfitted core reaches the foundry. Having the core, or core assembly, accurately fitted reduces the labor of core setting in the foundry to a minimum, and increases the molder's output.

The sleeve for the Knight engine has presented many difficulties from a casting standpoint. It must be absolutely free from dirt and porosity, must be

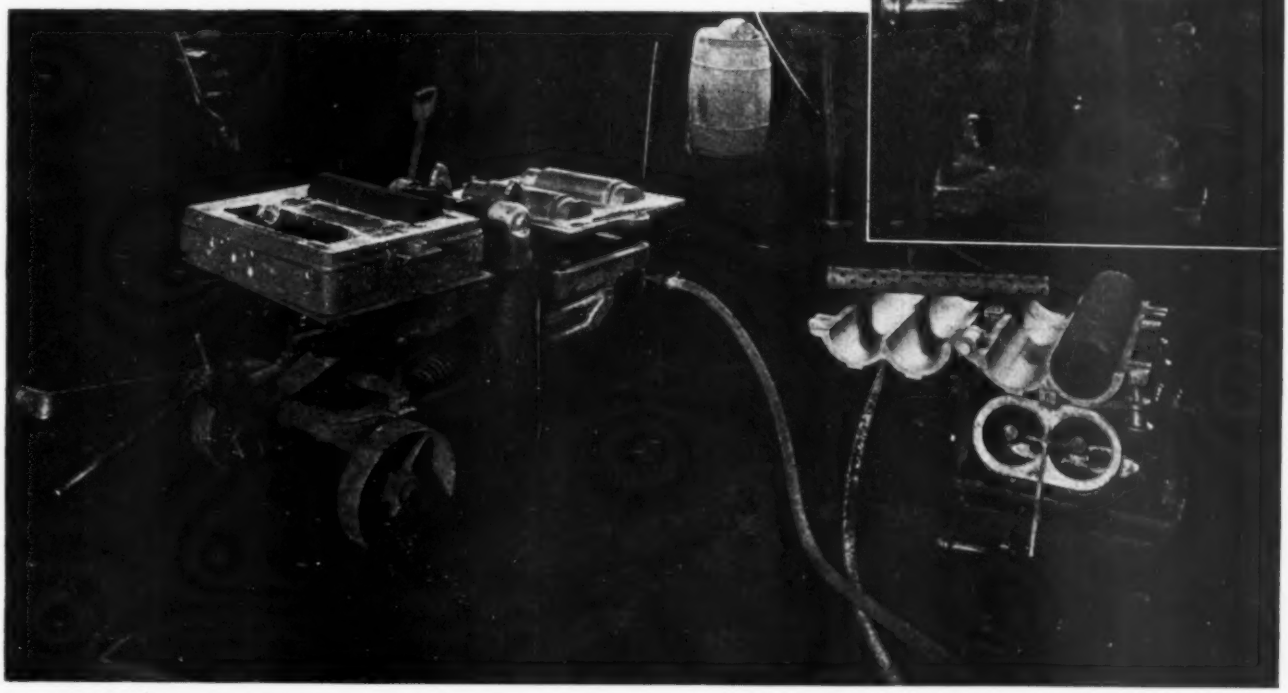


FIG. 8—MOLDING AND COREMAKING MACHINES AND FIXTURES FOR MAKING SLEEVE CASTINGS FOR THE KNIGHT MOTOR FIG. 9—RIGHT ABOVE—MACHINE FOR MAKING GREEN-SAND CORES FOR KNIGHT MOTOR SLEEVES

strong and have excellent wearing qualities. The standard rig for making these is illustrated in Figs. 8 and 9. Fig. 9 shows a double corebox mounted on a small jar-ramming machine. This corebox is on trunnions so that it can be swung to a horizontal position, and to the top is hinged a guide arrangement for locating one end of the core arbor. This is better illustrated in Fig. 8 where the box is shown open with one of the cores removed, and a core arbor lying across the half-open box. The top guide for locating the top of the arbor is shown hinged down at the front.

FIG. 12—BELOW—ASSEMBLY OF 6-CYLINDER JACKET CORE

Girl on the right is assembling two parts of the jacket core in a special jig used for drying the paste. The one at the left is assembling three parts of the jacket. These are later clamped in a machine for drying

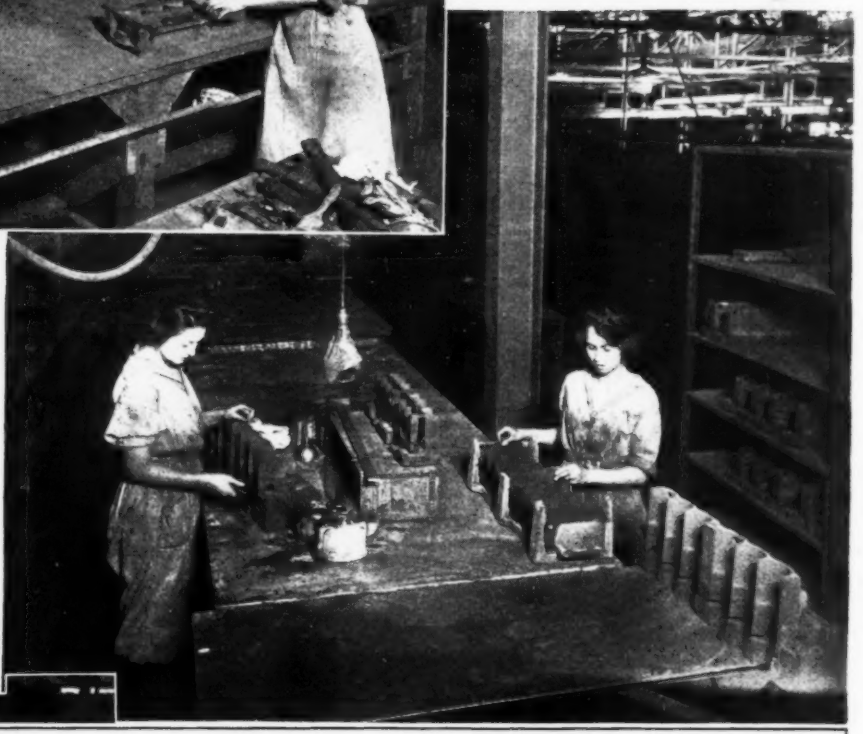
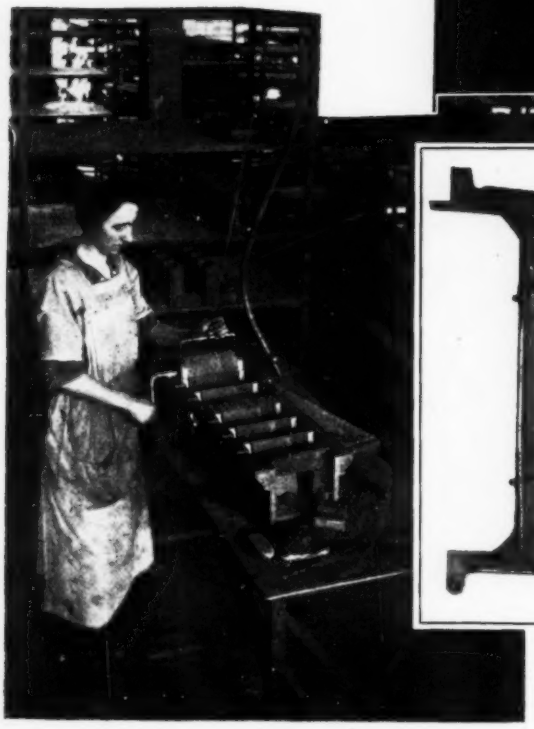


FIG. 10—ABOVE—OPERATIONS ON CORES FOR 6-CYLINDER JOB

Girl at left is using a corrugated rubbing-down plate. The one in the center at the rear is gaging openings in the core with hardened steel gages, while the two girls at the right are sanding cores with special jigs

FIG. 11—BELOW—REAMING JACKET CORE FOR 6-CYLINDER JOB



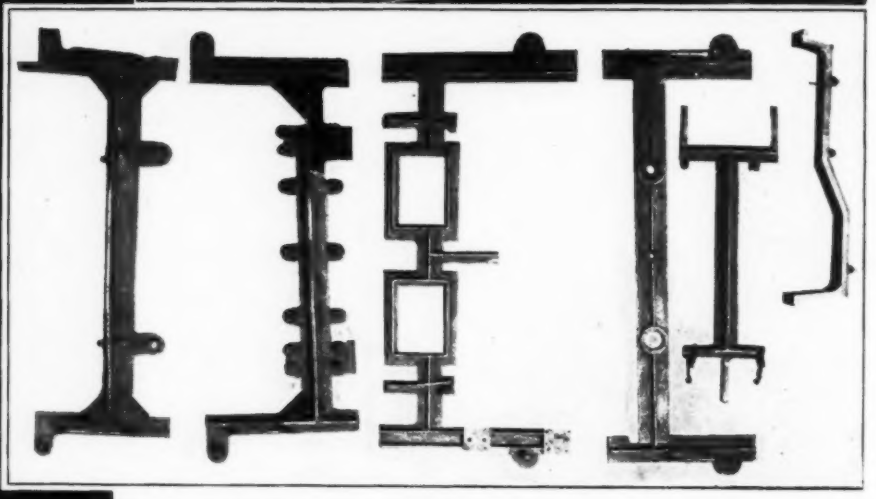


FIG. 13—SIX JIGS FOR SETTING CORES FOR THE 6-CYLINDER JOB

The main frame of each of these jigs is aluminum, but all wearing or setting faces are provided with steel bushings or facing. Vertical locations are made by flush plunger attachments

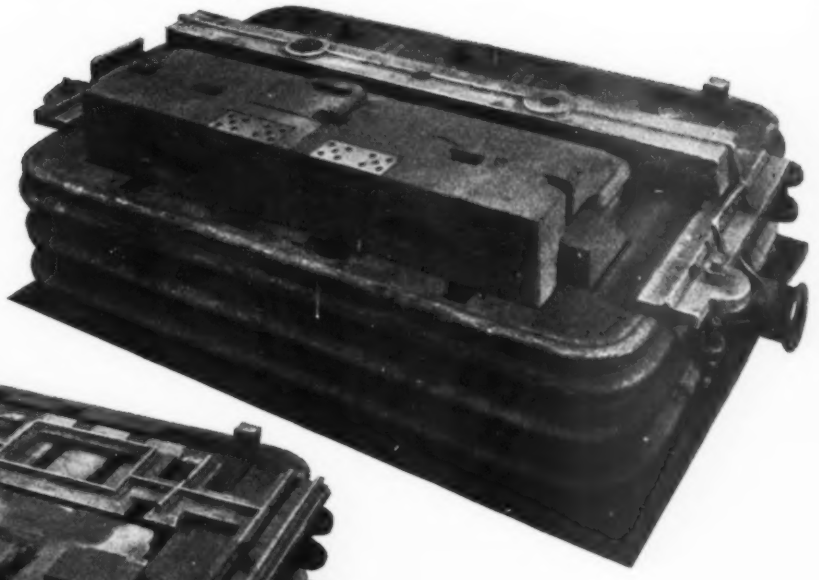


FIG. 14—BELOW—DRAG MOLD WITH CRANKCASE CORE AND ITS JIG IN PLACE

FIG. 15—ABOVE—TOP JACKET JIG IN PLACE

FIG. 16—AT RIGHT—DRAG MOLD WITH LOWER JACKET IN PLACE AND SETTING JIG OVER FLASK PINS

These perforated pipe arbors are dipped in clay wash before placing in the mold. The arbor is then located, sand introduced, and the jarring started. At the left, Fig. 8, may be seen the plain rollover machine, furnished by the International Machine Co., Chicago, used for making the drags, and one of the green-sand cores has already been set. The cores are set in the drag before the drag is carried to the floor, thus reducing the amount of work necessary to place the mold and cores on the floor.

To illustrate in greater detail some of the methods used for producing accurate cores we will follow through some of the steps in the making of a six cylinder job. Fig. 11 shows a jacket barrel reaming jig. The counterbalanced reaming roller is run down into each barrel of the jacket until it meets the stops. In practice every other barrel is reamed; the jig is then cleaned, and the alternate barrels are reamed.

Fig. 10 shows a number of fixtures which have been gathered together on one bench for illustration. At the left is shown a corrugated plate used for smoothing the ends of the jacket cores, or for surfacing any other core requiring a smooth surface, the core being rubbed back and forth against the corrugated surface. The girl in the center at the rear is using a hardened steel plug to gage openings in the jacket, while the girls at the right are sanding the top and bottom respectively of certain jacket cores. As already stated these sanding blocks are used for removing the majority of the stock, and the final jointing is done with the hardened steel jointing broach or bar.

In Fig. 12 the girl at the right is assembling two units of a three-part jacket in a machined fixture, which is used for

drying the core after assembly. The girl on the left is making the final assembly, taking the parts that have been dried in the drying fixture, and placing them together with the other cores and the intake cores.

We might go on showing many other views of core room operations, but believe that those given cover the principles involved. We will now turn our attention to the molding and core setting of the six-cylinder job under consideration Fig. 17 shows a general view of the floor, with the two jar-ramming rollover molding machines used for producing copes and drags. These machines were furnished by the Grimes Molding Machine Co.

Fig. 13 shows the six core-setting jigs used on this job. These jigs being of considerable size are made of aluminum, so as to reduce the work necessary in handling them, and, as may be noted, they are equipped with suitable steel handles where necessary. All locating pins are bushed with hardened steel, and where a jig is used for locating vertically, a spring actuated plunger is placed in hardened bushings. When the jig is in position, if the core is properly set, this plunger should stand level with the top of the bushing. If it is lower it shows that the core is too low, while if it projects it shows that the core is not set low enough in the mold.

Fig 16 shows the drag with the lower jacket in place, and the lower jacket setting jig in position. Fig 14 shows the crankcase cores in position with the crankcase core-setting jig in place. This jig is used for setting the lower half of the crankcase cores.

Fig. 15 shows the jig in position for locating the top jacket cores. All core and mold setting jigs used in the foundry, as has already been stated, are under constant inspection of the tool room or pattern shop, and also a certain number of castings are cut up from time to time to make sure that coreboxes, patterns, and jigs are functioning properly. In addition to this a certain number of castings from each day's run are put through the shop every day in advance of the general run, so as to check up on all operations including coreing, molding, and the metallurgical work.

The castings selected from each day's heat for tests are marked with paint, the color of which is changed each day. Monday's castings have a blue spot on them, Tuesday's yellow, Wednesday's pink, Thursday's white, Friday's green, and Saturday's red.

Necessarily only the castings machined in the company's own plant can be tested in this way, but since the Knight motors are machined and assembled complete in this plant, and a number of the Overland models are completely machined, it makes it possible to send the necessary number of castings through each day to keep an accurate check on the foundry, and this accurate inspection is in no small way responsible for the remarkably small casting loss in this shop.

The aluminum castings used by the company are also produced in this plant. The principal cores for these molds are made in green sand entirely. All of the practice in this division of the foundry follows the same accuracy in regard to machine work that is practiced in the iron foundry, and it is unnecessary to multiply the illustrations and descriptions of equipment. All aluminum pistons are made with green-sand cores, following the practice already outlined for gray iron.

Society Issues Index

The American Society for Testing Materials has issued an index of proceedings covering the contents of volumes XIII to XX, 1913 to 1920, of the proceedings of the society. The index includes all committee reports and technical papers. In the index of authors references to committee reports appear under the names of the chairmen, vice chairmen and secretaries of the committees concerned.

Book Review

Technical Analysis of Steel and Steel Works Materials, by Frank T. Sisco; cloth, 543 pages, 6 x 9¼ inches; published by McGraw-Hill Book Co., Inc., New York, and furnished by THE FOUNDRY, Cleveland; price $5.

Analytical methods to be clearly understood need more than the bare statement of the outlines, for many pitfalls in the operations must be closely watched and minute details must be observed. Therefore, the author has fully elaborated on all the methods which he gives so that each step can be clearly understood. He has written the book with a view of the needs of the many chemists working in steel works laboratories who have not had the advantages of a college training, and the methods are stated in as nontechnical language as possible. The basis of correct results being the sample, this phase of the subject is fully explained as are the equipment and laboratory arrangement. Limits are suggested for allowable error in the different methods so that the chemist may know how close to the actual results each method should be relied

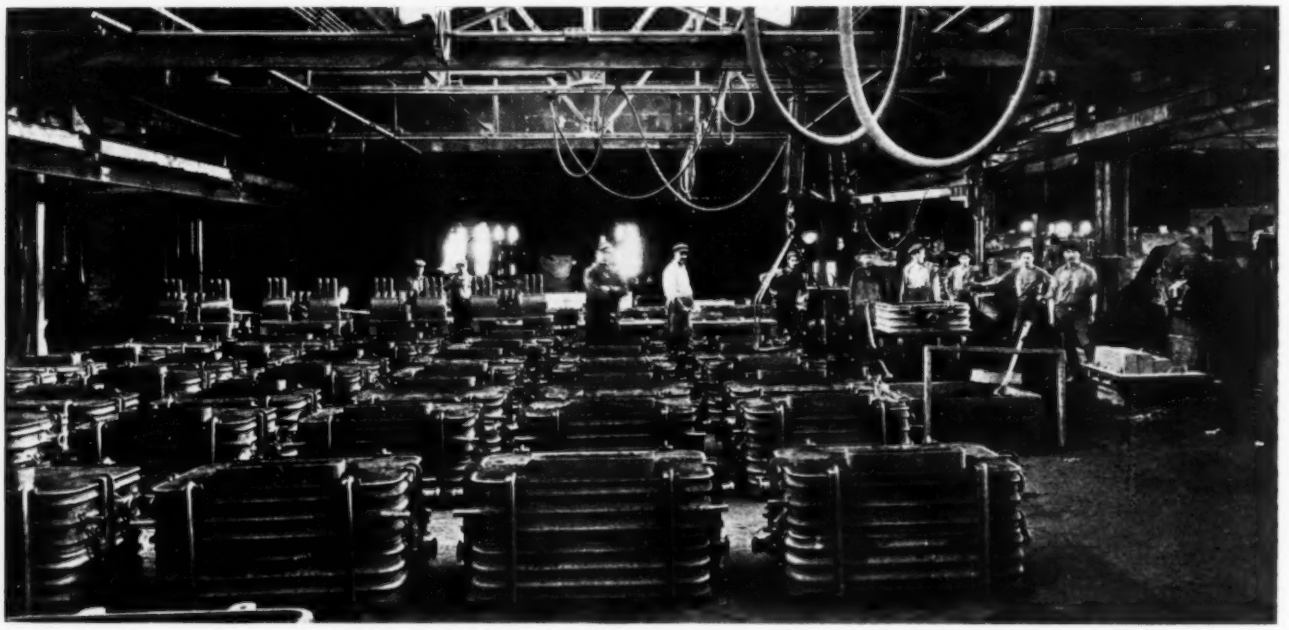


FIG. 17—GENERAL VIEW OF MOLDING FLOOR FOR THE 6-CYLINDER JOB SHOWING JAR-RAM ROLLOVER MACHINES

upon. Of course, methods for the analysis of plain carbon steel are essential, and these are given, both for use when time is not an essential and for the preliminary analysis where quick, reliable results are required In the methods for the analysis of alloy steels the effects of the different elements on the analyses are explained clearly in detail.

Internal Structure of Solid Solutions

By W. Rosenhain

HAVING been asked to give a lecture dealing with one of the theoretical aspects of metallurgy, the lecturer took as his subject the internal structure and constitution of solid solutions. He began by defining that somewhat paradoxical term and then described the various ways in which alloys solidify and the manner in which solid solutions are formed, pointing out that essentially all the constituents of alloys are solid solutions.

He then asked how solid solutions are formed and why they are formed. Hitherto the answer to these questions has been given in a series of thermo-dynamic formulae which, however valuable, do not give a satisfying physical description of what really happens. He proposed to develop a purely physical conception and began by showing that a solid solution crystal must be regarded as a self-strained structure owing to its lower melting point which means that the energy required to be given to the atoms in order to bring them into the liquid condition is less and, therefore, the crystal itself must contain stored up energy. The degree of solid solubility must be determined by the maximum amount of energy which can be stored. A further step in our knowledge of the nature of solid solutions, however, is rendered possible by the modern advances of *X*-ray analysis of crystals. These advances have thrown an enormous amount of light on the whole question of the structure of crystals, although to a considerable extent the discoveries which have been made by their means are confirmations of knowledge gained earlier by cruder metallographic methods. The net result of the *X*-ray analysis of crystals shows that they are built up of atoms arranged upon what are known as space lattices, and typical examples of certain space lattices were described and illustrated by means of diagrams. A consideration of the nature and size of atoms then followed, which serves to show that when the atoms of a metal are arranged upon a space lattice whose dimensions are known, there can be no considerable interstices between the atoms. The structure of a simple crystal of a pure metal is thus quite intelligible, but the formation of a solid solution gives rise to the question where the atoms of the dissolved metal go when they pass into solid solution. Of the various possible ways in which the dissolved atoms might be distributed, the only feasible one appears to be that they take the place of some of the atoms in the solvent metal upon its own space lattice. This *substitution* theory of solid solution structure has been tacitly assumed by several workers, but a proof has only recently been obtained in the case of certain alloy systems, notably that of copper and aluminum. The main point which the lecturer desired to bring out, however, was that wherever a stranger (solute) atom takes the place of one of the atoms of a metal on a space lattice, this substitution must produce a powerful effect upon the whole of the lattice, at any rate, in the neighborhood of the solute atom. This effect is of the nature of a distortion, which may be either larger or smaller according to the similarity or otherwise of the solute atom to the solvent. Further, according to the physical properties of the solvent metal, the distortion produced may be either almost entirely local or almost entirely general. From these considerations, it is possible to arrive at a clear and definite explanation of many of the most striking properties of solid solutions. Thus, the distorting effect of the presence of solute atoms and the storage of energy in the lattice ultimately set a limit to solid solubility; at the same time the distortion causes a disturbance of the smooth gliding surfaces by means of which plastic deformation can take place, and thus produces a hardening of the metal. It follows that the hardening effect of an alloying element present in solid solution is approximately inversely proportional to its solid solubility, and many examples of alloys were quoted to show that this relationship approximately held in fact. More interesting still is the explanation which this theory furnishes of the depression of the freezing point and the widening of the freezing range in the case of solid solutions. Melting is conceived as being due to the special separation of the atoms on the space lattice beyond a definite limiting distance. Where the lattice is perfectly uniform this occurs throughout the whole of the crystal at the same temperature and the pure substance therefore has a definite melting point at one temperature. In a solid solution, however, where the lattice is either locally or generally distorted, there are various values of inter-atomic distance in different parts of the crystal and accordingly different parts reach their limiting inter-atomic distance; that is, their melting point, at different temperatures. Thus a commencement of melting is made at a temperature which may be considerably lower than that at which the whole of the crystal becomes liquid. It is further shown that where the solvent metal is hard and strong, and lattice distortion is therefore general rather than local, there is not much difference between the commencement and end of melting or freezing. On the other hand, in softer metals where lattice distortion is likely to be local rather than general there are wide differences between the beginning and end of the melting range. A striking confirmation of the theory put forward is found from the alloys in which the addition of the alloying element causes a rise of the melting point. This is found to be associated with a contraction of the lattice dimensions precisely in the manner which the theory would indicate.

On the basis of this same theory an explanation of the mechanism by which diffusion can occur in a solid crystal is provided, also explanation for the brittleness and certain other properties of intermetallic compounds.

In summing up his conclusions, the lecturer pointed out that if his inferences were completely supported by fact, when further observations had been obtained, the considerations put forward might well be regarded as forming a general theory of the inner structure of solid solutions and of alloys. Ultimately it might be hoped that the whole of the properties of alloy systems could then be calculated from a knowledge of the atomic constants of their constituents.

Abstract of a lecture given in New York at the Feb. meeting of the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers.

Devise Flexible Charging System

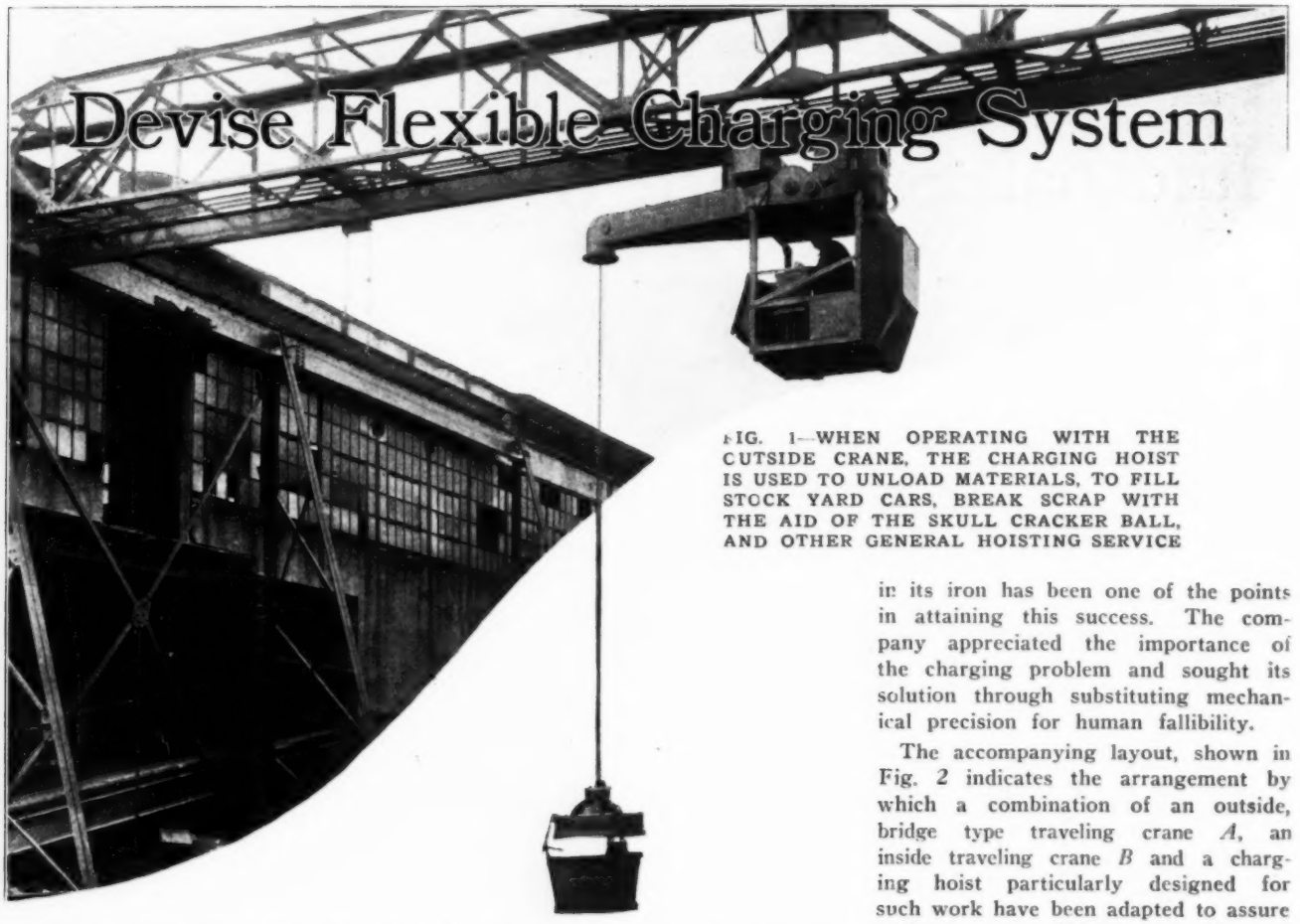


FIG. 1—WHEN OPERATING WITH THE OUTSIDE CRANE, THE CHARGING HOIST IS USED TO UNLOAD MATERIALS, TO FILL STOCK YARD CARS, BREAK SCRAP WITH THE AID OF THE SKULL CRACKER BALL, AND OTHER GENERAL HOISTING SERVICE

UNDER the most favorable circumstances, the work connected with hand charging a cupola furnace is not highly desirable. Lifting pigs of iron, tumbling heavy chunks of scrap through the charging door and other necessary operations are physically trying when accompanied by the extreme heat which prevails at times and the occasional chance of being mildly gased by escaping fumes, the prospect is not sufficiently alluring to attract many to seek such employment voluntarily. The growing scarcity of labor still further complicates the problem of securing men for this work.

The human equation as worked out on the charging floor is one of the most important steps in securing high grade castings. Though the work itself is classed as common labor, intelligence is required to a degree which often is not appreciated. The importance of securing the different constituents of iron, scrap, and coke according to a definite formula and of charging these materials in the proper order may be drilled thoroughly into the foreman in command. He may be schooled in these features and the vital necessity for observing rules laid down and usually he is conscientious in observing them; but variables are always liable to creep in. A case is cited of a pig iron producer who was reproached for sending iron too high in silicon, despite the well known fact that higher prices are commanded for the increasing percentages of this element in commercial iron. Examination disclosed that the customer's statement was true to this extent. A colored laborer instructed to go to stack No. 8 in the yard and there fill a truck with the required amount of iron, found it much simpler to use the supply in stack No. 2, closer to the elevator, which seemed to have ample iron for his requirements and he knew it would need much less work to wheel it back. The only trouble arose from the fact that No. 2 rick contained 8 per cent *silvery*, and thence came the high silicon analysis reported. Instances of this nature might be supplied in great number, but this point is plain. Hand charging at the best requires intelligence and care both alike, incompatible with the class of labor which can be induced to do the heavy work of lifting, loading, wheeling and unloading iron into the cupola.

Stress Good Iron

The Muncie Foundry & Machine Co., Muncie, Ind., has built its success through meeting the requirements of a high class demand. Definite quality in its iron has been one of the points in attaining this success. The company appreciated the importance of the charging problem and sought its solution through substituting mechanical precision for human fallibility.

The accompanying layout, shown in Fig. 2 indicates the arrangement by which a combination of an outside, bridge type traveling crane *A*, an inside traveling crane *B* and a charging hoist particularly designed for such work have been adapted to assure uniform and efficient operation in handling materials from the railway car to the yard and from the yard into the cupola.

Making the Charges

As may be noted, the house track from the Pennsylvania railroad extends along the stock yard, and the yard crane commands it so that pig iron and scrap may be picked up and dropped into the separate bins. All stock then is delivered from the bins in cars to a location near the scale shown at *C*. Here complete charges, according to definite directions are made up on cars placed on the scales. The crane loads the approximate weight on the cars, shortages or overages being compensated from small service bins containing portions of all materials used. The cars then are pushed forward to the turntable *D*, caused to follow successively, the line of the arrows shown. Only one cupola is operated each day. If No. 1 cupola is in service, the successive cars are placed in a line directly under the yard crane when it is in the position indicated in this illustration. The charge which is to be used first is made up last and the others in sequence are placed on the track until an entire day's requirement is made up and in position on the track reach-

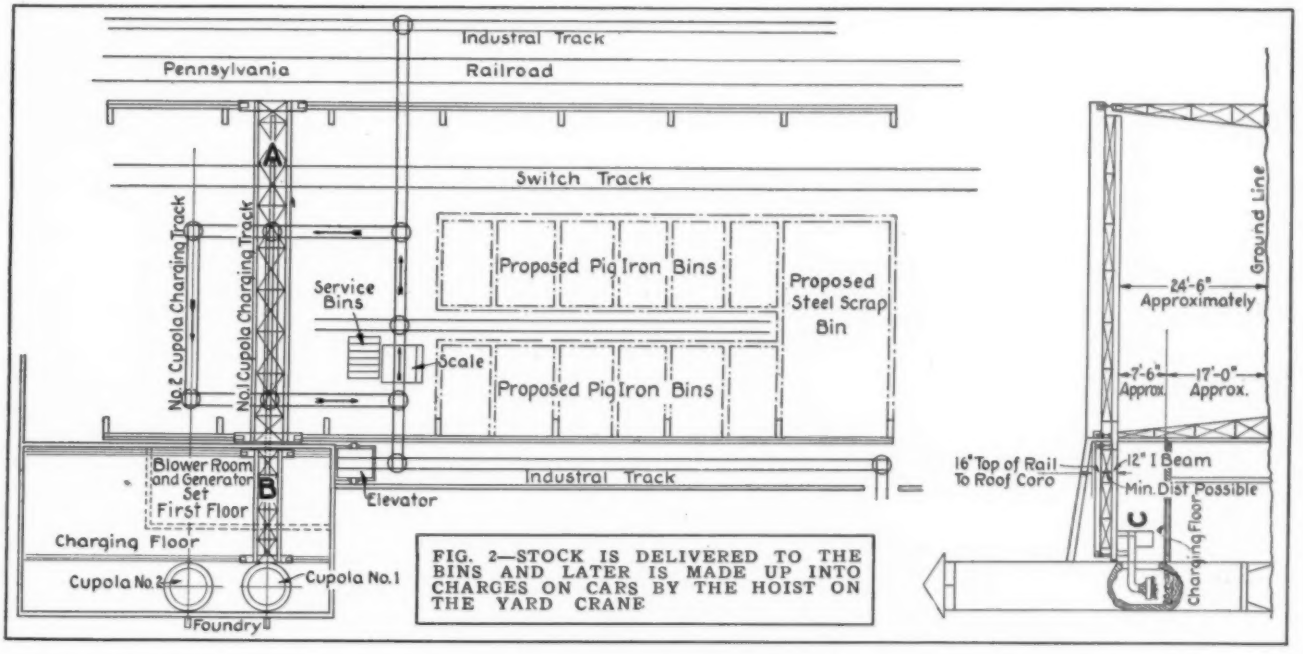
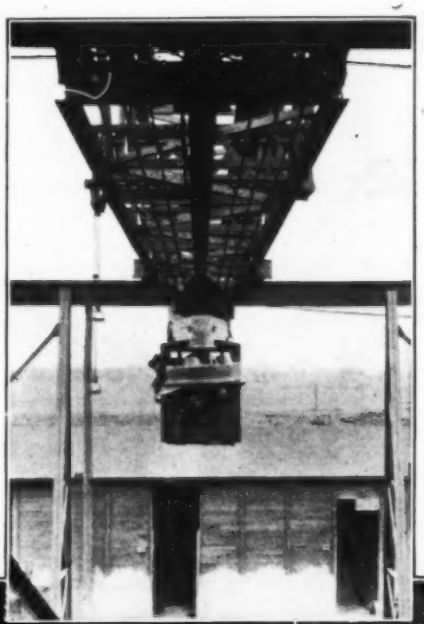


FIG. 2—STOCK IS DELIVERED TO THE BINS AND LATER IS MADE UP INTO CHARGES ON CARS BY THE HOIST ON THE YARD CRANE

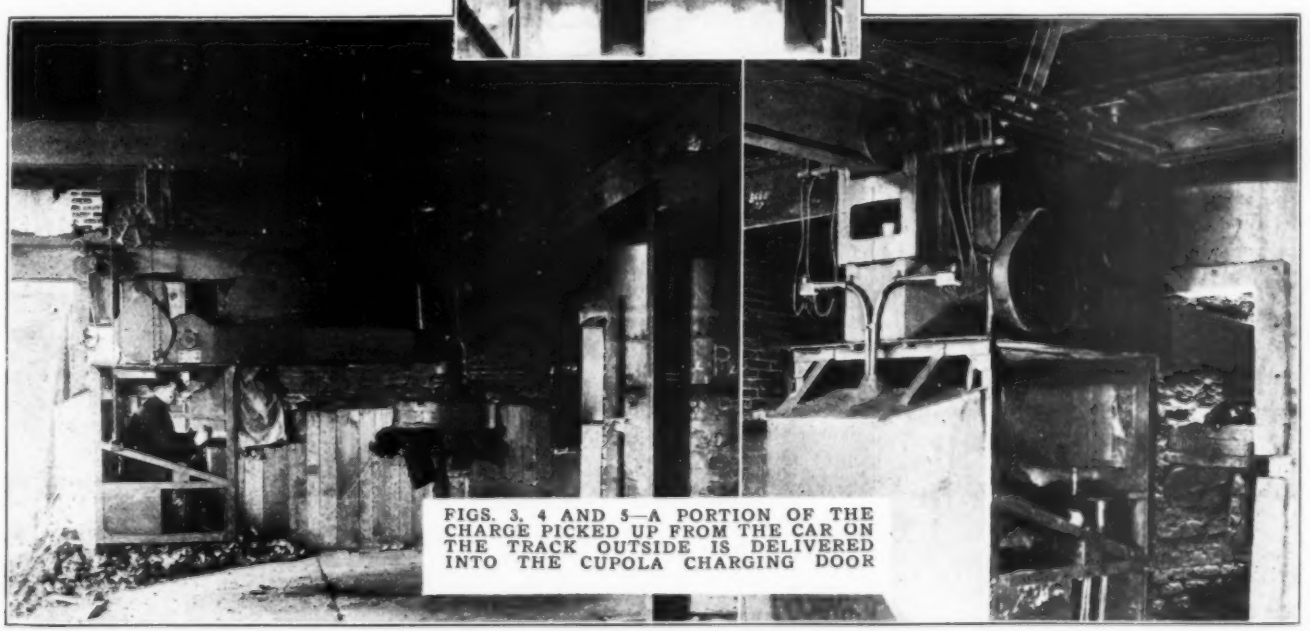
ing out directly in a line from the cupola to be served.

The central and actuating factor in the entire charging system is the hoist made by the P. H. & F. M. Roots Co., Connersville, Ind. This hoist is arranged and mounted to operate upon the 66-foot span yard crane, and the 22-foot span charging floor transfer crane. Both these appliances are controlled from the hoist cage.

The outside crane, made by the Chisholm & Moore Mfg. Co., Cleveland, is used to unload all raw materials either with a magnet or grab bucket. It serves to make up the charges upon the cars previously mentioned, and then is used in conjunction with the inside crane made by the manufacturer of the yard crane in a manner hereafter described. After the charges are made up on the cars, not a pound of material is handled by manual labor, all materials being delivered directly from the cars to the inside of the cupola.



When the charges on their respective cars are arranged ready to start the cycle of charging, the charging hoist is run out along the outside crane, the magnet dropped down and the material, either coke or iron is lifted up to the full height, so that the suspending cable is sheathed within the frame of the hoist. The hook on the magnet is sheathed within the cantilever arm and a close fit is provided so that swinging or damage to the hoist ropes while the arm is inside the cupola are avoided. The hoist then is run forward off the yard crane to the inside charging floor crane and along this until the coke bucket or the iron, as the case may



FIGS. 3, 4 AND 5—A PORTION OF THE CHARGE PICKED UP FROM THE CAR ON THE TRACK OUTSIDE IS DELIVERED INTO THE CUPOLA CHARGING DOOR

be, is inside the center of the cupola. The charge is dropped, and the charging hoist again returns to complete the cycle of operations.

The speed with which the cycle is completed may be judged from the fact that the hoist speed is 25 to 30 feet per minute, and the travel of the hoist along the cranes is at the rate of 300 to 350 feet per minute. About 15 tons of iron per hour is handled from the ground outside into the furnace. The labor saving feature of the arrangement described is shown by a comparison with the old hand practice when charges were drawn up the inclined runway, shown at the left in Fig. 1. Formerly 24 men were required to handle an output of 80 tons of iron per day from one cupola. This, of course, involved all the yard and charging floor labor necessary to handle all material from the railway car to the stock pile, from the yard to the cars, and from the cars into the cupola, making three separate lifts of the same material or 240 tons in all. At present 6 men can make up and charge the required materials to obtain the production of 80 tons per day of metal at the spout.

Details of the various component parts of the system are explained more readily from the accompanying illustrations. The charging hoist when serving as a trolley and operating cage for the outside crane is capable of the most flexible operation. The three operations, traveling the main bridge crane, running along the I-beam trackway and either lowering or raising the magnet on the hoisting cable may take place simultaneously.

When the yard crane is placed so that its lower I-beam trackway is directly in line with that of the inside crane, an interlocking device, operated by the two hand chains shown in Fig. 4 positively engages the two cranes in alignment, and a similar device on the inside crane serves a similar purpose. When the interlocking device is opened on either crane, it serves as a block, preventing the charging hoist from being run off the end of the track. These combined locks and safety blocks can be operated only by a positive and intentional act, that is, pulling the hand chains respectively referred to. Coke is handled from the charging floor or from the ground as may be desired. A novel rig has been devised by the Roots company for conveying and handling this material. A bucket, shown in Figs. 7 and 8 and with a holding capacity of 400 to 600 pounds of coke is set down in proximity to the coke supply and is filled by forking the coke into it. When it is desired to transfer this coke into the cupola, the magnet of the charging hoist, inert so far as its magnetic properties are concerned, is dropped down, so that the weight of the magnet itself depresses the hinged clamps shown at *A*, Fig. 8. This throws the hooks forward so that they engage the top of the magnet, and the bucket may be lifted without fear of its being disengaged.

The hoist then is run forward so that the cantilever arm enters the cupola. A pull on the hook *B* disengages a latch and permits the rod supporting the bell bottom to drop, allowing the latter to assume a position 10 inches below the bottom rim of the bucket. The distribution of coke this affords is evident from Fig. 7.

The hoist then is withdrawn and the bucket dropped down in the desired position for loading. The magnet is energized, causing the horizontal ends of the hinged clamps to fly up, thus disengaging the hooks from the top of the magnet.

Features of the charging hoist, although they have been explained in an earlier issue of THE FOUNDRY will be of interest in their relation to this novel charging installation. The hoist consists

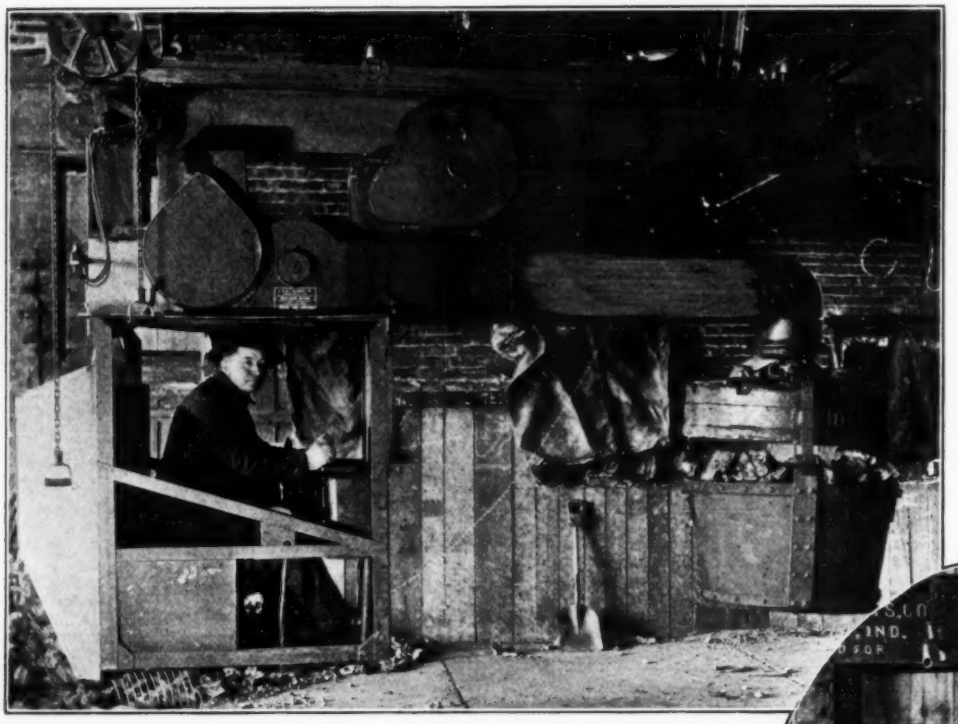


FIG. 6—AT THE LEFT—WHEN COKE IS HANDLED, THE BELL BOTTOM BUCKET IS ENGAGED DIRECTLY ON THE MAGNET AND THE BUCKET IS CARRIED INTO THE CUPOLA, WHERE A PULL ON THE TRIP PERMITS THE CHARGE TO BE DROPPED FIG. 7—BELOW—THE COKE CHARGE IS SPREAD AS IT DROPS FROM THE SWIVELED BELL—GUIDES SHOWN AT A CAUSE THE BOTTOM TO SEAT ITSELF WHEN THE BUCKET IS PLACED ON THE FLOOR

essentially of the cantilever arm, hoisting mechanism, operator's cage, magnet on the hoist cable and two double swiveling, four-wheel trucks.

The cantilever arm is a machined steel casting, the forward end of which forms a cup, into which the head of the magnet fits snugly, when drawn up in the position shown in Fig. 3. This serves to protect the hoist, and power cables from damage due to the heat within the cupola. The power cable which conveys current for energizing the magnet is reeled up into the arm on a specially grooved drum assuring against overlapping with the hoist cable. The power cable is attached to the magnet by a compensating spring which prevents it from carrying any of the load which comes upon the hoisting cable. The brake on the hoist motor is designed to hold the full load torque of the motor. Minute control is provided so that the hoisting drum may be brought to rest instantly either from the hoisting or lowering direction.

The operative switchboard is slate and is mounted in a fire and waterproof cabinet immediately back of the operator's seat and access is provided through a steel door. Overload relays which open a magnetic contactor when the load exceeds the ampere rating are provided. These have a reset button which may be used when the load is reduced. The hoist motor can be operated in either the upward or downward direction by reversing the single controller. The magnet switch and contactor, controlling the current to the magnet is independent of the overload magnetic contactor circuit and is not affected by the opening of this circuit from overloading the motors or through pushing the open and reset buttons. Current is disconnected from the magnet circuit only by opening the main line switch. This feature assures against dropping a load of iron from the suspended magnet, should a motor be overloaded on either the hoist, or the traveling crane circuits.

The magnet used is manufactured by the Ohio Electric & Controller Co., Cleveland. It is waterproof and the use of the asbestos insulation provides heat resisting qualities that prevent damage when magnet enters the cupola to deposit the charge during the time the wind is on.

The operator and the controllers within the cage are shielded from the cupola heat by steel guard, provided with a 100-mesh wire gauze screen, which gives free vision to the operator, but deflects heat, dust and sparks.

Although the services performed by the charging hoist in conjunction with the two traveling cranes are extensive, the company has developed another use. After the cupola bottom is dropped, the hoist is run forward, and the magnet dropped down through the cupola to the top of the refuse pile beneath, where the unmelted iron which has come down with the charge dropped is picked up and returned directly to the charging floor for reuse.

When Added Steel Causes Shrinkage Cracks

Question: Our cupola charge is made up of 250 pounds pig iron, 250 pounds scrap and 50 pounds mild steel. Sometimes the lighter section of certain castings pulls away from the heavier section and we have been wondering if the steel is responsible.

Answer: Steel may be indirectly responsible for shrinkage and cracks in that it has reduced the silicon content beyond a safe limit. Assuming that your pig iron carries 2.50 per cent silicon, your scrap carries 1.75 per cent silicon and your steel of course carries none, the resulting metal will show approximately 1.75 silicon which is too low for thin castings. If you intend to continue using the material in the same proportion you will have to increase the silicon and probably the manganese content by the addition of a suitable amount of ferrosilicon nd ferromanganese in the cupola or by substituting pig iron with a higher silicon and manganese content than you are using at present.

FIG. 8—THE COKE BUCKET HAS THREE SELF LOCKING CLAMPS, A, BY WHICH IT IS AFFIXED TO THE MAGNET WHEN THE LATTER DROPS UPON IT—THE TRIP FOR THE BELL BOTTOM IS SHOWN AT B

Purchase Steel Company

The Pennsylvania Electric Steel Casting Co., Hamburg, Pa., which is operating the former plant of the Driscoll-Reese foundry, has been taken over by H. R. and E. R. Shollenberger. E. M. Shumo, Stillwater, Minn., has been appointed general manager.

Book Review

Metals and Their Alloys; by Charles Vickers; cloth, 767 pages, 6 x 9 inches, published by Henry Carey Baird & Co., New York and furnished by THE FOUNDRY for $7.50 net.

Charles Vickers, nonferrous editor of THE FOUNDRY needs no recommendation from this publication on the thoroughly practical character of his writing. Long years of intimate contact with the castings industry and the manner in which he conducts the questions and answers department where problems of every nature are solved for the readers' benefit have fitted him admirably for a work such as this. While the new volme is based upon an earlier work, Metallic Alloys, by Brannt, the revision has been so thorough and complete that a new book has resulted.

The book is adapted to the needs of the foundryman, plant manager, chemist, metallurgist or worker. Its presentation is simple and direct and the principles of "How and Why in Brass Founding" have been faithfully followed by the author. Mr. Vickers considers alloys and their component metals from their origin to their finished state as useful objects. The properties of strength, ductility, toughness, lightness, color, hardness, cheapness, conductivity and resistivity, or the attributes which recommend them for bearings are dealt with in a clear and understandable manner. Formulas are given in profusion, in a way which will be undertsood easily even by the novice, and the methods and procedure of mixing metals are set forth in detail.

The newer and less common metals and alloys are treated and their applications are noted. Suggestions for melting and handling such difficult casting metals as monel render the work unique, while the directions for die casting bronze as well as the low-fusion alloys seldom will be encountered elsewhere. While basicly simple in its presentation, the work is thoroughly scientific. As a contribution to the theoretical side of nonferrous practice, the work adds much to the sum of metallurgical knowledge.

The subject of melting is covered in a thorough manner. From the more ancient form of crucible furnaces down to the most modern types of reverberatory, oil-fired or electric units, the various classes of melting mediums are described and the uses to which each is adapted are suggested. A chapter is devoted to the subject of brass for rolling where formulas with their trade names, methods for handling and annealing are presented. The alloys of mercury or amalgams and the alloys of precious metals are discussed. A brief portion is devoted to iron alloys of general interest while the chapter devoted to miscellaneous alloys is made up largely of a

tabulated list of special mixtures, arranged with reference to the elements involved and containing suggestions as to the uses and limitations of these alloys.

Surface coloring, a subject of practical interest to the brass foundryman is covered in one complete chapter, and the practical problems encountered in using scrap metals with advice as to the proper handling of mixtures in which scrap is used are dealt with at some length in another section.

Miscellaneous foundry data including information on melting points of metals, fuels, weights of various materials, formulas for different everyday computations, first aid suggestions and a glossary of foundry terms conclude the book.

Test Sand Permeability

The bureau of standards is conducting a series of tests to discover a sand with 100 per cent permeability, it is announced. Having a standard sand with a known permeability, the suitability of every molding sand could be expressed in percentage of a sand found to be 100 per cent permeable. To accomplish this result, several sands have been investigated. One commercial grade of sand, which is a very pure silica sand of a fairly uniform degree of fineness, has been found on a number of tests, both dry and with as high as 4 per cent of moisture to be 100 per cent permeable.

Oxidation Due to Low Coke Bed

Question—We find small holes in our castings. These holes have a dull gray color and are round and smooth. The heavy castings machine easily but it is almost impossible to drill or machine the smaller ones. The charge is made of 600 pounds No. 2 pig iron; 150 pounds steel scrap; 750 pounds gray-iron scrap and sprues. A flux of 25 pounds of limestone is added to each charge. The melting zone is 33 inches in diameter and 18 inches above the tuyeres.

Answer—The details which you give are not full enough to enable us to determine the exact cause of your trouble. We would judge that the hard castings are due to too low an amount of silicon in your pig iron and would suggest that you use some No. 1 pig iron.

The holes probably are caused by oxidation and to avoid this you should raise the height of your coke bed. The bed of coke should be of such a height that the metal will come from the furnace in from 8 to 10 minutes after the blast is put on. Oxidation also will lower the silicon content.

Fitting Plants Increase

Census bureau reports show that in 1921 the number of plants manufacturing steam fittings and hot-water and steam heating apparatus in the United States was 274, an increase of 25 over 1919 and 11 over 1914. The number of persons engaged was 37,086 in 1921, 43,864 in 1919 and 31,748 in 1914. The cost of raw materials used was $50,213,000 in 1921, $72,016,000 in 1919 and $26,921,000 in 1914, while the value of the finished product was $127,367,000 in 1921, $160,285,000 in 1919 and $63,922,000 in 1914.

Aluminum Industry Grows

New aluminum produced in the United States in 1922 was valued at $13,622,000, an increase of 25 per cent over 1921, according to the federal geological survey. Imports for 1922 up to Sept. 22, when the tariff act became effective, totaled 31,482,893 pounds for all classifications, compared with 26,177,852 pounds in the corresponding period of 1921. Exports in 1922 included 2,808,964 pounds of plates, sheets, bars, strips and rods, against 499,124 pounds in 1921, and 4,548,939 pounds of manufactured articles, compared with 2,307,782 pounds in 1921.

Increase Capitalization

The capital stock of the Ross-Meehan Foundries, Chattanooga, Tenn., is to be increased from $60,000 to $1,260,000 it has been announced. The company was organized in 1888, and has a large surplus which is to be converted into capitalization. G. F. Meehan is president, Robert E. Meehan is vice president, and George Y. Forman is secretary and treasurer. The products of the company are steel, malleable-iron and gray-iron castings. According to President Meehan prospects for business during 1923 are excellent.

Installs Electric Furnace

The American Metal Products Co., Milwaukee, manufacturers of a copper-aluminum steel alloy of high tensile strength and acid resisting properties, recently has installed a Detroit rocking-type electric furnace to take care of its growing business in ingots and castings.

Grinding Wheel Firm Reorganizes

The National Grinding Wheel Co., Inc., Buffalo, recently completed the reorganization of its production department which now is in charge of John J. Russ, who for the past 27 years has been associated with the Carborundum Co., Niagara Falls, N. Y. The National company was founded in 1906. Its officers are W. H. Farnsworth, president, C. W. Zimmer, treasurer and John J. Russ, general manager. The company uses artificial abrasives; an aluminum abrasive being adapted to grinding high-tensile materials, while a carbide of silicon material is adapted to grinding low-tensile products.

Shop Will Specialize on Pressure Castings

The Reliance Foundry Co., Slinger, Wis., recently incorporated at Madison, was promoted and organized by James H. Wilkins and others of Milwaukee and Slinger to manufacture gray-iron and semisteel castings.

The Reliance Foundry Co., while catering to a general jobbing business, will specialize on high quality castings for air, automobile, ammonia, diesel engine, water, steam, or other high grade pressure castings, semisteel tire molds, blank gears, dies, etc., containing 30 to 50 per cent steel scrap.

Establish Warehouse in St. Louis

A foundry supply warehouse and office has been established by the J. W. Paxson Co. at 214 Morgan street, St. Louis. The requirements of the foundry trade in that district will be studied and products will be stocked to meet requirements. Distribution will be made by the Mine & Mill Supply Co. of which L. H. Zintgraff is president, and P. C. Bryant is secretary-treasurer.

Pattern Plant Starts To Make Castings

The Bryan Pattern & Machine Co., Bryan, O., manufacturer of patterns, has opened a foundry division devoted to the production of brass, bronze and aluminum castings. This is the natural enlargement of a department that has been making pattern castings since the organization of the company.

All equipment is installed and production is now under way. It is the intention to specialize in small and medium nonferrous castings. The foundry has a daily melting capacity of 10,000 pounds. The pattern plant which was rebuilt following a fire in 1919, has over 25,000 square feet of floor space and employs under the best of working conditions 250 patternmakers.

Organizes Sales Company

E. C. Ranney and O. L. Weaver have organized the Ranney-Weaver

Co., Cleveland, for the purpose of operating Cleveland sales offices for the Erie Malleable Iron Co., Erie, Pa., Fedders Mfg. Co., Buffalo and the Weldless Tube Co., Wooster, O. Mr. Ranney for more than 20 years was director of purchases for the Winton Motor Car Co. and Mr. Weaver at one time was connected with several automobile distributors in the Cleveland district. For the past five years he has been manager of the Star Rubber Co., Akron, O.

Will Handle Welders and Welding Metals

The Wilson Welder & Metals Co., Inc., recently has arranged for representation of its welders and welding metals with the following concerns:

Charles A. Strelinger Co., Detroit.

Mine & Smelter Supply Co., Denver, Colo., Salt Lake City, Utah, and El Paso, Texas.

North Coast Electric Co., Seattle, Tacoma and Spokane, Wash., and Portland, Oreg.

Briggs-Weaver Machinery Co., Dallas, Texas.

J. G. Christopher Co., Jacksonville, Fla.

Eliminating Iron in Brass Alloys

By P. W. Blair

That iron is a dangerous impurity in brass and copper alloys is well established. Many attempts have been made to produce a good inexpensive bronze by combining iron with copper and its alloys, but such experiments have resulted in proving that unless carbon in the iron is removed, the results will be unsatisfactory. Since all iron contains carbon the safe solution is to keep the iron out.

When iron or steel finds its way into the crucible with brass chips or turnings it does not alloy, but produces a dangerous mechanical mixture. The iron forms into small nodules and these nodules seem to absorb all the carbon in the surrounding metal forming themselves into hard steel. These nodules vary from a small pin head to the size of a pea according to how much the metal has been stirred while molten.

As far as the foundryman is concerned, the castings would seem to be all right, but it is from the machine shop standpoint that trouble and expense accrue. In machining brass castings, the edge of any tool steel will crumble or break when it strikes one of these nodules. This is one of the reasons why the presence of iron in brass castings is dangerous. Thousands of dollars worth of tools have been ruined, much valuable time lost and a great deal of annoyance has been caused by these troublesome nodules of iron and steel. They are especially dangerous to tools in automatic and semi-automatic machines because the operator does not know for a time that a tool has been damaged and during this time good work may be spoiled.

It has been demonstrated that with the utmost precaution it is difficult to keep brass chips free from iron and steel. In shops where both brass and iron are machined, the brass chips always contain iron. No matter how carefully the lathes and machine tools are cleaned between operations on different metals iron turnings also steel chips will contaminate the brass chips.

Even in shops where brass is worked exclusively more or less iron and steel finds its way into the brass chips. Even the wear or particles from the steel tool or at the cutting point will do mischief. Washers, screws and various other articles in iron and steel also manage to get in unobserved. If anyone of these happens to get into the melted metal, bad castings are to be expected. Fluxes and furnaces of different kinds have been tried out but so far there is only one remedy and that is to either use a flux which will remove the carbon or else eliminate the iron entirely and the last mentioned is recommended.

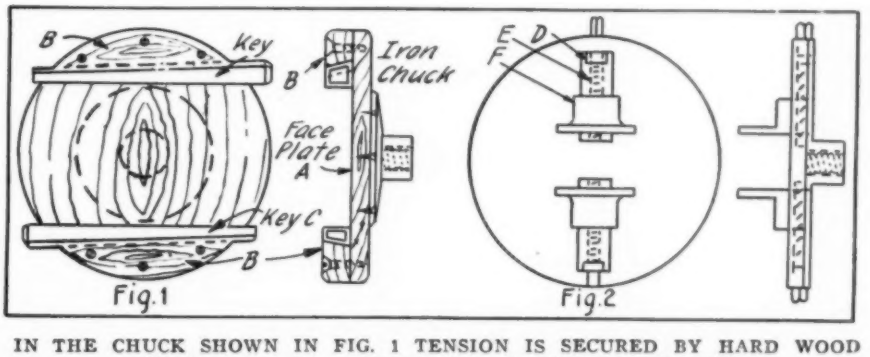
Pattern Shop Chucks of Unusual Design

By M. E. Duggan

Two styles of chucks particularly useful in holding coreboxes during the process of boring and other purposes that readily will suggest themselves to the practical patternmaker, are shown in the accompanying illustration. Up to 12 inches diameter the chuck shown in Fig. 1 may be made of cast iron, above that size hardwood will be found satisfactory. In any size maple wedges are employed. When made entirely of wood the two side pieces *BB* are glued and firmly screwed to the face plate *A*. The inner edges of the side pieces are planed at an angle to retain the wedges or keys *CC*. The piece of wood to be turned may be centered and chucked in a comparatively short time by driving the upper and lower key into place. Where the stock is too small to be locked by the keys, filler pieces may be employed. However, it is preferable to have on hand a number of keys of varying widths. They may be cut readily on the band saw. To guard against accident the key end should not extend beyond the edge of the face plate. The chuck shown in Fig. 2 will answer the same purpose as that shown in Fig. 1. It is designed somewhat similar to those attached to engine lathes, but is much lighter. It is a plain disk finished all over and provided with two slots in which the jaws may be adjusted to various size openings. The jaws are tapped to receive the screws *E*. One end of the screw fits in a hole in the chuck while the other end works in the collar *D*.

Pieces of wood may be attached to the jaws either inside or outside bored or turned to fit any particular job. The jaws may be reversed in their position so that the face will come in contact with the interior face of a hollow pattern. Under other circumstances V-pieces may be fixed to the jaws to hold a piece of wood in the rough during the process of facing, turning and boring the projecting parts. The piece then may be reversed in the chuck and similar operations performed at the opposite end. Another advantage of this chuck is that the partly finished piece may be removed at any time for any purpose and when it is returned it will run quite true. However, the use of the V-pieces on finished surfaces is not recommended.

The treasury department recently has ruled that Belgian sand of all classes is free of duty under paragraph 1675 of the tariff act.



IN THE CHUCK SHOWN IN FIG. 1 TENSION IS SECURED BY HARD WOOD WEDGES. IN FIG. 2 THE SAME RESULT IS OBTAINED THROUGH A PAIR OF SCREWS

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....504 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
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Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

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Pig Iron Production Increased

PIG IRON production registered a sturdy total for 1922. The recovery from the previous year's exceptionally low total is reflected in the figures issued by the American Iron & Steel institute. In 1921, a total of only 16,688,126 tons of all classes of iron is noted, while the year just past stepped up to 27,219,904 tons. This represents an increase of 63.11 per cent, but still fails to reach the phenomenal totals shown by the three post-war years, 1918, 1919 and 1920. Taking the average for those three years, shown to be 35,665,331 tons, the 1922 production is shown to be at the rate of 76.2 per cent of the production of those three years. The output of foundry iron and ferrosilicon is given as 3,976,431 tons, which is an increase of 54.84 per cent over the previous year's total of 2,568,136 tons. Malleable grades show the most remarkable advance. The total given for 1921 was only 457,340 tons, and for the past year this was raised to 1,051,495 tons, establishing a record increase of 129.92 per cent. A comparison with the average of the three-year period previously mentioned gives still further evidence of the increased use of malleable pig iron. The average production of this grade for 1918, 1919 and 1920 is shown to be 1,145,971 tons, so that last year's output of 1,051,495 tons was 91.9 per cent of the exceptional years named. An explanation for this increased sale of malleable is furnished by the growing use of malleable grades in gray iron foundries, particularly those making automotive castings. An interesting feature is furnished by the figures given for charcoal iron in 1922. A total of 224,731 tons is given as the output of hot and warm blast iron, while none is recorded for the cold blast product which has been dropping steadily over the past five years.

Used Sand Brings Company Profit

PROFITS in some industries are made on the by-products, notably in the packing industry in which it has become proverbial that every portion of the pig is used except the squeal. In the metallurgical field the by-product coke oven is a notable example of the saving of products formerly wasted in the old type beehive oven. Here expensive equipment is erected to conserve products which otherwise would be lost. In the foundry industry, a large portion of the sand is reused and water mills have been installed to recover the metal dropped with the cupola bottom, while in brass and aluminum shops magnetic separators are applied to separate iron and steel from the nonferrous scrap. Although as much sand as possible is used over again in the foundry, much is hauled out as waste. Until recently, the only method of getting rid of this sand has been to acquire a dumping ground and fill this with the old sand. However, during the past year a steel foundry in the East has disposed of its sand not only without the expense of providing a dumping ground, but in addition it has made of the waste sand a source of income. This company found a contractor who has agreed to take all the sand available and use it in road construction. In this work burned sand from the steel foundry has been found valuable and the contractor takes all the used sand the foundry provides, storing it in winter and paying the foundry a dollar a ton for it. All that is required of the foundry is to run the sand through a screen to recover gaggers and scrap metal. The sand then falls into a hopper and is carried by a bucket conveyor to the freight car.

Trade Outlook in the Foundry Industry

ADVANCING prices and a tightening labor shortage are two terse phrases which tell the whole story of present conditions in the foundry industry. Materials continue to rise, backed by a demand which seems to know no limit. Foundries are purchasing iron well into the second half of the year and are increasing their specifications for immediate deliveries. Many in the latter class are forced to accept widely varying analyses due to shortages in the grades sought. Prices of castings are strengthening. Steel castings and malleables alike are advanced about 10 per cent. Radiators have increased 5 per cent over the recent advance of a similar amount.

Labor Sets Limit

The rate of foundry operation no longer is dependent upon the orders received. The malleable industry, practically throughout all its classifications is working to the full capacity with the available supply of workmen. The level of factory employment in New York state is within 12 per cent of the maximum during the prosperous period of 1919-1920, according to the industrial commissioner. The National Founders association reports a scarcity in practically every section, augmented by the competition of the building trades and other lines furnishing outdoor employment. A survey shows a scarcity of both skilled and unskilled men in 22 of the large centers north of the Ohio river and east of the Mississippi. Rates paid to common labor in foundries range from 35 to 55 cents with a strong tendency upward induced by the payment of from 75 to 87½ cents in building trades. Foundry operations in the East approach 75 per cent, limited, as stated, by the supply of workmen. In Ohio the rate of foundry operation is at 67.8 per cent of normal for the month of February and this has probably been increased during March. The Ohio State Foundrymen's association figures for the previous month show 59.34 per cent of normal.

Prices of Raw Material for Foundry Use

CORRECTED TO MARCH 28

Iron		Scrap	
No. 2 Foundry, Valley	$29.00 to 30.50	Heavy melting steel, valley	$26.50 to 27.00
No. 2 Southern, Birmingham	27.00	Heavy melting steel, Pitts.	27.00 to 27.50
No. 2 Foundry, Chicago	32.00	Heavy melting steel, Chicago	23.00 to 23.50
No. 2 Foundry, Philadelphia	31.76 to 31.13	Stove plate, Chicago	25.75 to 26.25
No. 2 Foundry, Buffalo	30.00 to 31.00	No. 1 cast, Chicago	30.00 to 30.50
Basic, Valley	31.00	No. 1 cast, Philadelphia	28.50 to 30.00
Basic, Buffalo	29.50 to 30.00	No. 1 cast, Birmingham	23.00 to 24.00
Malleable, Chicago	32.00	No. 1 cast, Buffalo	27.50 to 28.50
Malleable, Buffalo	30.50	Car wheels, iron, Pittsburgh	29.50 to 30.00
Coke		Car wheels, iron, Chicago	28.50 to 29.00
Connellsville foundry, coke	$8.25 to 9.00	Railroad malleable, Chicago	29.50 to 30.00
Wise county foundry, coke	8.50 to 9.50	Agricultural mal., Chicago	29.50 to 30.00
		Malleable, Buffalo	27.50 to 28.50

Construction Mounts

Building construction, which has held to unprecedented levels during the winter is increasing steadily with the advancing season. Competitive conditions are forcing higher prices for building materials and this, coupled with the high labor costs is leading many to council defering new projects until later. In fact, Gen. R. G. Marshall, manager of the Association Contractors of America distinctly advises against undertaking new work in the face of the present conditions. However, much new work is going ahead and the combined volume of projects under construction and the concurrent replacement of stocks is supporting a strong demand for plumbers goods, pipe, building hardware, sanitary ware and miscellaneous jobbing castings. Stove and furnace foundries and radiator shops are working at top speed, and purchasing iron into the third quarter of the year. Municipalities are buying castings in greater volume than has been noted for several years. This is true particularly through the New England states, where building construction is intensive. Cast iron pipe foundries in many cases are refraining from bidding on new work, due to the volume of orders on their books.

Contributing Causes

No single line of activity is responsible for the mounting demand for castings. Automotive manufacture is proceeding at top speed. In fact, automobiles are enjoying the greatest boom recorded. According to the National Automobile Chamber of Commerce, the February output was 270,995 cars, and only June and August, 1920, can show higher records. The production is the largest ever recorded for February. At the same time sales have more than kept pace and deliveries on some makes of automobiles are set ahead as far as June 1. Railroads, too, are intensive buyers of castings, backed by increasing car orders. The American Railway association reports an increase in car orders for February over the preceding month. While the amount of freight business is fluctuating slightly, many freely predict that an actual shortage of cars will arise in the early summer, when the full effect of increased industrial activity, ore and other material shipments mount. A net car shortage of 65,000 freight cars is reported at the end of February. Agricultural implement plants are busy. The bureau of labor statistics reports an increase of 12.3 per cent in the number employed in agricultural implement lines during February, while sales throughout the rural districts are mounting. Sales of commercial steel castings for February were 9 per cent below those for the preceding month, according to the Steel Founder's society, but the bookings were 93 per cent of capacity.

Brass Sales Grow

Demand for nonferrous castings is active and foundries in this class are working at from 75 to 80 per cent of normal. Prices for nonferrous metals, based on New York quotations in the Daily Metal Trade of March 28 follow: Casting copper, 16.75c; electrolytic copper, 17.37½c; Straits tin, 47.75c; lead, 8.25c to 8.30c; antimony, 8.87½c to 9.00c; aluminum, No. 12 alloy, open market, 23.50c to 24.50c. Zinc is 7.80c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

DANIEL J. McAVOY, for several years general foundry foreman of the Bunting Brass & Bronze Co., Toledo, O., has been appointed general superintendent of the Bryan Pattern & Machine Co., Bryan, O. Mr. McAvoy has held executive positions with various malleable, gray iron and nonferrous plants since 1909. With the Bryan company he will be in direct charge of the recently enlarged brass foundry division as well as the wood and metal pattern departments.

George Zeilenbach has been engaged

DANIEL J. McAVOY

as foundry superintendent by the Fagan Iron Works, Jersey City, N. J.

John Cronin has accepted the position as superintendent of the Bond Foundry & Machine Co., Manheim. Pa.

John G. Maroney has severed connections with the Oil Tool Service Mfg. Co., Anaheim, Cal., to accept the superintendency of the Clark Turner Piston Co., Los Angeles.

Dana E. Williams has been elected president and general manager of the Semi-Steel Foundry Co., Barberton, O., to succeed Herman Peterson who died recently from injuries received in an accident.

Clifford F. Messinger, general sales manager of the Chain Belt Co., Milwaukee, has been elected second vice president. He has served as a director for several years. He is a member of the board of the Interstate Drop Forge Co., Milwaukee.

A. W. Crozier, who for the past year has been a member of the Cleveland office of the Norton Co., Worcester, Mass., grinding wheel division, has been transferred to the Philadelphia office of that company.

Howard Coonley, president of the Walworth Mfg. Co., Boston, was tendered a dinner at the Boston Tavern, March 26, by the employes, in honor of his tenth anniversary as head of the company.

B. H. Bristow Draper, treasurer of the Draper Corp., Hopedale, Mass., has been elected a director of the First National bank of Boston, to fill the vacancy caused by the death of George Albert Draper.

J. L. Edwards, for the past four years district engineer for the Mahr Mfg. Co., with headquarters at Pittsburgh, has resigned to take the position of district manager of the Pittsburgh territory for F. J. Ryan & Co., Wesley building, Philadelphia.

Thomas W. Pangborn, president of the Pangborn Corp., Hagerstown, Md., has been chosen a member of the third district committee of the National Founders' association. He succeeds Edward L. Langworthy of the Adams & Westlake Co., Philadelphia.

B. Olney Hough, for many years editor of the *American Exporter,* has resigned from that position to establish himself as export counsellor, consultant and adviser to banks, exporters and manufacturers. He has established offices under the name of B. Olney Hough, Inc., at 17 Battery place, New York.

William Cunningham has been made special assistant to J. W. Johnson in the supervision of the plants of the Kokomo Brass Works, the Ford & Donnelly Foundry, the Hoosier Iron Works and the Kokomo Malleable Iron Works, all of Kokomo, Ind. Mr. Cunningham has been connected with these industries almost 20 years.

R. P. Snelling, treasurer of the Saco-Lowell shops, Boston, was made a vice president of the company at its recent annual meeting. P. D. Howe, who was assistant treasurer was named treasurer and Frank J. Hale, who was general agent, also was named vice president. He has been succeeded by Robert F. Herrick Jr., who was assistant general agent. The new vice presidents have been actively associated with the business for 40 years.

Leonard Sumner who was elected president of the British Institute of Metals at the annual meeting in London on March 8, is chairman and managing director of the Broughton Copper Co., 6 Broad street, London, and Manchester. He is a graduate of Victoria university, Manchester, from which he holds a degree of

LEONARD SUMNER

master of science. He has been associated with the Broughton Copper Co. since 1893, first as assistant works manager and later as works manager, prior to his present appointment. In 1905 he also was chairman of John Bibb & Sons, copper smelters, Liverpool. He is an original member of the British Institute of Metals for which he served as a member of council in 1908 and 1909. W. Murray Morrison, who has been elected vice president of the British Institute of Metals, is managing director of the British Aluminum Co. Ltd., London. Sir Thomas Rose, also elected vice president, is chief chemist and analyst at the royal mint, London.

Electrochemists To Meet

Subjects of interest to the foundrymen will be considered at the spring meeting of the American Electrochemical so-

ciety, to be held in New York, Thursday, May 3 to Saturday, May 5. A paper by Frank W. Brooke, William Swindell & Bros., Pittsburgh, will treat of the electric furnace. Other papers of interest to foundrymen will be presented by C. E. Williams, C. E. Sims and C. A. Newhall, U. S. bureau of mines, and by D. B. Sakaltwalla, Vanadium Corp. of America.

Will Give Prize for New Foundry Device

Last year at the Rochester convention of the American Foundrymen's association the first Obermayer prize competition was held. Provision is made for a similar contest this year and the co-operation of foundry superintendents, foremen and workers is requested in making this second contest more valuable than the first. The following are the conditions laid down for the prize competition:

This prize, which is known as the S. Obermayer Co. prize, will be given to the person submitting a drawing or a model of some jig or device which, in the opinion of the judges embodies the best ideas for a device to help in the economical production of castings.

The jig or piece of equipment for which this prize is given shall not be patentable, but shall be such a device as can be constructed in any foundry and used in the production of castings, in coremaking, molding, pouring, or handling operations.

The models or drawings of the devices which are submitted in this contest will be on exhibition during the annual convention and exhibit of the association at Cleveland, April 28 to May 3.

Contestants for this prize will be limited to men who are foremen or workers in foundries, or in some department of a plant operated in connection with a foundry, and they should file notice with the secretary of the association of their desire to contest, and receive further information as to conditions.

The Charron Engineering Sales Co., Detroit, has been appointed district representative for the Hanna Engineering Works, Chicago, manufacturer of molding machines and other foundry equipment.

Cleveland Metallurgists Hold Annual Meeting

B. D. Quarrie, Otis Steel Co., Cleveland was elected chairman of the Ohio section of the American Institute of Mining and Metallurgical Engineers at its annual meeting held in Cleveland, Monday, March 12. The other officers chosen included Dr. H. M. Boylston, Case School of Applied Science, vice chairman; A. G. McKee, Arthur G. McKee & Co., vice chairman; and C. B. Murray, Crowell & Murray, chemists, secretary-treasurer.

An address by Dr. Walter Rosenhain, National Physical Laboratory of Great Britain, Teddington, England, was the feature of the annual meeting which attracted over 100 metallurgists and engineers from Cleveland, Akron, Youngstown, Mansfield, Dayton and Columbus. The address, entitled "The Structure and Constitution of Alloys," traced the work of the British scientists in exploring the binary and ternary alloys, both ferrous and nonferrous, and showed the practical results of these studies in securing correct ratios of elements used, and upon the heat treatment of the alloys. Dr. Rosenhain even predicted early progress in developing useful alloys of nickel and copper which will respond to heat treatment.

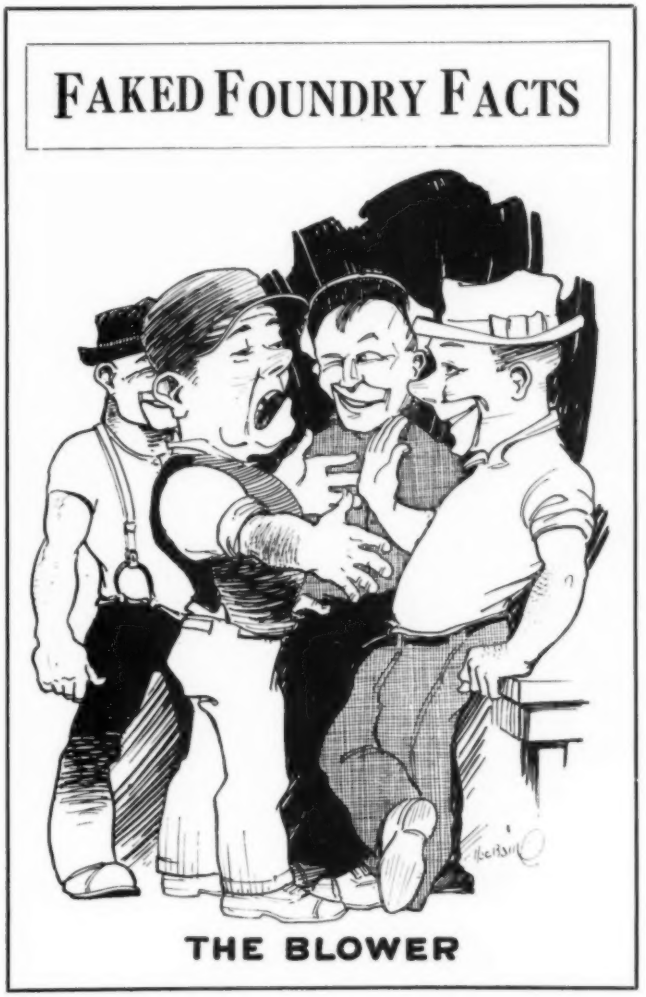
Dr. Rosenhain, who is making an extended lecturing tour of the United States addressed meetings at the Case school, March 12 and 13.

The British Institute of Metals Meets

At the annaul meeting of the British Institute of Metals, which was held in London, March 7 and 8, it was announced that the society now has 1436 members. It was stated that the work of the corrosion research committee and the aluminum-corrosion research subcommittee will be continued. At the present time the work of the latter committee is largely centered on the anodic production of hydroxide coatings, which appear to promise success. Arrangements also have been made for the Institute of Metals to become custodian of standard samples of aluminum of various purities as well as certain common aluminum alloys which will be prepared by the national physical laboratory, Teddington, London. These samples will be issued to persons who wish to check their analytical methods by reference to some agreed standard.

Leonard Sumner, chairman and managing director of the Broughton Copper Co. Ltd., Manchester and London, was unanimously elected president for the ensuing year.

W. Murray Morrison, managing director of the British Aluminum Co. Ltd., London, and Sir Thomas Rose, chief chemist and analyst of the royal mint, London, were elected vice presidents. T. Bolton, of Thomas Bolton & Sons, Ltd., Widnes; C. A. Edwards, professor of metallurgy, University of Wales; H. B. Weeks, Vickers Ltd., Barrow-in-Furness; R. B. Dixon, engineer vice admiral, royal navy, London; S. Evered; and G. A. Boeddicker, were elected members of the council. It was announced that W. M. Corse, National Research Council, Washington, has been appointed honorary corresponding member of the council for the United States.



Prosperity Reflected in Buying

Better Conditions Among Castings Manufacturers Is Followed Closely by Purchases of New Foundry Equipment and Growing Orders for Parts and Repairs

INCREASED foundry melt has exerted a strong influence upon the sales of foundry equipment. New construction, long deferred, is again a factor in the market for machinery. Molding machines and cranes lead in the growing demand. Advances are announced in several lines of equipment, but deliveries are made promptly, particularly in standard lines. The Grabler Mfg. Co., Cleveland, has purchased dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland. The latter firm recently has received orders for sand blast machinery from the Gluntz Brass Foundry, Cleveland, and the Cutler Steel Co., Pittsburgh. The F. A. Coleman Co., Cleveland, will furnish a large, car-type mold drying oven to the Bayonne Steel Casting Co., Newark, N. J. The Canion Motor Co., 20 E. Lexington St., Baltimore, W. G. Canion, president, soon will direct the equipping of a large foundry requiring complete machinery, including four 10-ton cupolas. Literature from manufacturers is desired. Joseph Poulx, Thetford Mines, Que., operating a nonferrous foundry, soon will enlarge his plant and install a 32-inch cupola and will purchase a blower and other miscellaneous equipment and supplies. A new $250,000 foundry will be constructed at Barberton, O., as soon as a location can be obtained, depending upon the willingness of the city to extend water mains and other service lines.

Molding Machines Sought in Pittsburgh

WHILE demand for foundry equipment generally has fallen off in the Pittsburgh district, impetus has been given to the demand for molding machines by the increasing business coming to casting makers along with a decrease in the labor supply. More and more attention is being paid to machine molding so that manufacturers like the Herman Pneumatic Machine Co., Zelienople, Pa., report that from the standpoint of inquiries, the past 10 or 15 days has been the busiest period in their history. These promptly turn into orders and recent sales reported by the Herman company include four large machines to the Blackwood Electric Steel Corp., Parkersburg, W. Va.; one large rollover machine to the Buckeye Mfg. & Foundry Co., Overpeck, O.; a special round boiler section machine to the Niagara Radiator Co., North Tonawanda, N. Y.; two special bath tub machines to the J. L. Mott Co., Trenton, N. J.; two rollover machines to the Joseph Reid Gas Engine Co., Oil City, Pa.; one large rollover machine to Ferguson & Son, Hoboken, N. J.; a 25-ton jarring machine for the Llewellyn Iron Works, Los Angeles, Cal.; two special shaking out machines for the Brown Car Wheel Works, Buffalo, and two large machines for the National Brake & Electric Co., Milwaukee. Enough inquiries are in hand asking for prompt deliveries to assure a similar number of sales within the next 10 days or two weeks. Deliveries are fairly prompt owing to the fact that much of this equipment is standard and manufacturers are able to make it up in advance of peak demand periods. Two or three foundries are being projected in the Pittsburgh district and foundry equipment sellers report the receipt of inquiries from these for complete layouts of equipment. Hoist and crane sales are fairly active, the United Alloy Steel Corp., Canton, O., closing on two cranes with the Alliance Machine Co., Alliance, O.; the Galion Iron Works & Mfg. Co., Galion, O., and the Reeves Mfg. Co., Dover, O., ordering one 15-ton, 60-foot span crane and one 20-ton, 46-foot span crane, respectively from the Pawling & Harnischfeger Co., Milwaukee, and the Union Steel Casting Co., Pittsburgh, awarding a 10-ton crane to the Champion Engineering Co., Kenton, O. The United Engineering & Foundry Co., Pittsburgh, is taking bids on a small crane with grab bucket, as is the Pittsburgh Plate Glass Co., Pittsburgh, for its Zanesville, O., foundry. The Carnegie Steel Co. ordered three 125-ton ladle cranes for its addition at Duquesne works, from the Alliance Machine Co., Alliance, O. A large number of steel flasks have been ordered from the leading manufacturing companies, together with other small supplies, such as wheelbarrows, riddles, etc. One or two cupola lettings still are held in abeyance together with one or two lots of tumbling barrels. Foundry equipment sellers report a heavy demand for repair parts, but all believe that foundries generally are getting busy and occupying equipment they now have.

Activity Grows in the East

WITH foundry construction assuming larger proportions in the East than at any time in many months, demand for foundry equipment is increasing rapidly, with every indication that the second quarter, now getting under way, will be the most active period since 1920. Heavy buying is expected to develop following the Foundrymen's convention and exhibit in Cleveland the latter part of this month. During the past two weeks, according to one or two of the larger sellers, the volume of acual orders has fallen off slightly, nevertheless, buying has been active, with a number of sizable orders placed, and has been well in excess of any corresponding period in the first two months of the year, if not fully as large as the first half of March. The construction now getting under way includes not only a number of additional alterations but several new projects. This activity is particularly noticeable in the New England and eastern Pennsylvania districts. At the same time several projects are now in contemplation, which are likely to be started within the next two or three months. In a few instances, action has been temporarily deferred owing to the tight situation in the structural market and in at least two cases, insufficient supply of foundry labor is mentioned as a factor. However, these cases are isolated and a prospective builder of a foundry is likely to receive favor from some mills and fabricating shops that would not be extended where the work is not of industrial character. This is particularly true in the case of railroad shops, needed in maintaining or improving transportation. Among larger orders placed during the past two weeks is a complete foundry outfit, including cupolas, blowers, tumbling barrels, ladles, etc., for the Boston Stove Works, Reading, Mass. This business went to the Whiting Corp., which also has received an order for complete equipment for a new foundry to be erected by the American Engineering Co., Philadelphia, manufacturer of hoists and other mechanical lifting devices. Another sizable buyer is the newly organized Springfield Malleable Iron Co., Springfield, Mass., and still another the Martin Metal Corp., Newark, N. J., recently organized to operate an aluminum foundry. Included in the business placed by this latter concern are two molding machines, two oil furnaces, core ovens and electric sifting machine, and other items involving complete complement of supplies. The Weir Stove Co., Taunton, Mass., has closed on a

list, including cupolas and other melting equipment and the Jamestown Iron Works, Jamestown, N. Y., has bought cupolas, blowers, etc., for a new addition. Both orders went to the Whiting Corp. The American Brake Shoe & Foundry Co. has closed on some further equipment for its Portsmouth, Va. plant, to the same seller. Other buyers include the General Steel Castings Co., Newark, N. J., which recently closed on mixer, made by the National Engineering Co., Chicago, and the East Penn Foundry Co., Macungie, Pa., manufacturers of soil pipe and erecting an addition to its iron foundry. Included in equipment being purchased is a cleaning room outfit, a 30-ton cupola and a monorail system. Although an inquiry has not as yet been issued, it is known that the conveying equipment required for the new plant of the American Type Founders Co., in Elizabeth, N. J., will involve cranes of 1, 2 and 3 tons capacity, of the underhung type. Several other new construction projects are contemplated, for which equipment inquiries are expected soon. The H. B. Smith Co., Westfield, Mass., is taking bids on a 175 x 220-foot foundry addition. Beaudry & Co., Inc., Boston, manufacturer of power presses, will build a 70 x 140-foot addition, understood to be a foundry. A 10-ton crane has already been purchased. The Philbrick-Booth Foundry Co., Hartford, Conn., making some improvements, is inquiring for a 5-ton electric crane with 30-foot span. The Hazleton Iron Works, Hazleton, Pa., is preparing plans for an iron foundry to replace the structure recently badly damaged by fire. Approximately $75,000 will be expended. The Hinkle Foundry Co., Philadelphia, recently organized, contemplates the erection of a $25,000 foundry. Another project in eastern Pennsylvania calls for the erection of an $80,000 plant at Hatboro, Pa., by the Roberts & Mander Stove Co., Philadelphia. S. S. Fretz Jr. & Co., Philadelphia, manufacturers of steam fittings, brass goods, etc., has acquired the foundry of Lewis Campbell, Boyertown, Pa., and contemplates some improvements. The Bastain & Morley Co., Laporte, Ind., is reported to have acquired property at Conshohocken, Pa., for the erection of a branch plant costing approximately $25,000. Other projects include a new plant at Statesville, N. C., for the H. C. Turner Foundry Co., Inc., recently organized with $100,000 capital. A plant will also be erected by the American Iron Works, Kernersville, N. C., manufacturer of boilers and radiators. The company was recently organized with $75,000 capital. The Clearfield Foundry & Machine Co., Clearfield, Pa., establishing a new plant, is now figuring on necessary equipment. The Isabel Porter Co., Newark, N. J., is reported to be a small buyer at this time. The Standard Foundry Co., Buffalo, has closed on a 5-ton electric crane to the Northern Engineering Works. Possibly the largest crane order to be closed of late in the foundry field involves six for the United States Cast Iron Pipe & Foundry Co. for installation at Birmingham, Ala. The cranes were purchased from the Pawling & Harnischfeger Co., Milwaukee, and included one of 10 tons capacity, with 60-foot span, three of 5 tons capacity, 35-foot span, and two of 5 tons capacity with 25-foot spans. The National Cast Iron Pipe Co., Birmingham, Ala., closed on three electric overhead cranes to the Milwaukee Crane & Mfg. Co., Milwaukee. The Co-Operative Foundry Co., Rochester, N. Y., is contemplating the purchase of some new equipment, and it is understood the Newark Metal Mfg. Co., Newark, N. J., is in the market for tumbling barrels. Prices on equipment continue upward. One leading manufacturer of sandblast equipment expects to increase quotations at least 10 per cent in the near future, and only recently a manufacturer of molding machines has made an increase of 10 per cent. Small advances have also been made in flasks, binders and certain other supplies. The W. W. Sly Mfg. Co., Cleveland, recently has received orders for a core oven from the Covell Mfg. Co., Benton Harbor, Mich., a dust arrester from the Eastern Foundry Co., Boyertown, Pa., and tumbling mill and dust arrester equipment from the M. W. Kellogg Co., Jersey City, N. J.

Chicago District Demand Quickening

FOLLOWING the lull in demand for foundry equipment and supplies noted late in February and early in March, the former activity has been resumed and in every department from cranes and cupolas to ladles and trucks, manufacturers of foundry equipment find business active and insistent. This is to be expected when foundries are melting almost as much iron as at the high point during the war, as indicated by coke and pig iron sales. There still appears to be some hesitation on the part of foundrymen whether conditions will last sufficiently long to make it worth while to build new foundries or add largely to those now in operation. This has caused new work in the hands of engineers to lag, a condition which is intensified by the present high cost of building. Builders of molding machines find considerable activity, which includes both the small hand machines and the larger power devices. Considerable of this demand comes from the east, although all sections of the country participate in proportion to their importance as foundry centers. The Whiting Corp., Harvey, Ill., has sold to the United States Radiator Co., Detroit, a 78-inch cupola and a 5-ton electric crane; to the Ford Motor Co., Detroit, a 60-inch cupola; to the Link-Belt Co., Chicago, a 5-ton electric crane; to the Belfont Iron Works, Ironton, O., an 80-ton electric crane; to the Buick Motor Co., Flint, Mich., a 66-inch cupola; to the American Engineering Co., Philadelphia, a 48-inch cupola, and two 48 x 72-inch tumblers; and to the Boston & Maine railroad two 10-ton electric cranes. Buying of ladles and other small accessories is unusually active, indicating the heavy melt of iron. In minor supplies, sand, core oil, parting and such material suppliers find foundries taking considerable quantities. The Haynes Stellite Co., Kokomo, Ind., has purchased dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Erection of manufacturing building is being considered by the Ohio Pump & Brass Co., Columbus, O.

The Williamson Heater Co., Cincinnati, is drawing plans for the rebuilding of its plant which was damaged by fire recently.

The H. B. Smith Co., Westfield, Mass., is having plans prepared for the erection of a 1-story foundry building.

The plant of the Sidney C. McLouth Foundry Co., Marine City, Mich., which recently was damaged by fire, will be rebuilt.

Erection of a gray iron foundry at Ensley, Ala., is contemplated by the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

The De Soto Foundry & Machine Co., Mansfield, La., has let the contract for the erection of a 40-foot extension to its plant.

Part of the plant of the Hazelton Iron Works, Hazelton, Pa., recently was damaged by fire.

The Bronze Metal Co., Meadville, Pa., plans the erection of a 1-story plant building.

Erection of a foundry building to cost

about $200,000, is understood to be planned by the Piston Ring Co., Muskegon, Mich.

Part of the plant of the Warren Foundry & Machine Co., Phillipsburg, N. J., recently was damaged by fire.

The plant of the L. N. & N. Foundry Co., 2088 Scranton road, Cleveland, recently was slightly damaged by fire.

The capital stock of the Columbia Sanitary Mfg. Co., Jefferson, Ky., recently was increased from $300,000 to $500,000.

The Tips Foundry & Machine Co., Austin, Tex., has increased its capital stock from $40,000 to $120,000 and changed its name to the Tips Engine Works.

The brass foundry of the John B. Douglas Co., Cincinnati, will be moved shortly to the company's new plant at Carthage, O.

The Lunkenheimer Co., Cincinnati, has started moving its foundry division from the old plant in North Fairmount, to the new plant at Carthage, O.

The Central Foundry Co., Holt, Ala., has let a contract to the Ingalls Iron Works Co., for the erection of a foundry building, 140 x 364 feet.

A 1-story brick and steel foundry building will be built by A. Kinkl & Sons Co., Chicago, to be utilized in connection with its forging plant.

The Frank J. Smith Foundry Co., St. Louis, recently was incorporated with a capital stock of $8000 by F. J. Smith, O. F Karbe and J. J. Waddock.

The Marshall Furnace Co., Marshall, Mich., plans to rebuild its plant which was damaged by fire recently. The building will be 1-story, 130 x 250 feet and cost about $50,000.

Capitalized at $10,000, the Atlas Die Casting Corp., Worcester, Mass., recently was incorporated by Alexander B. Campbell, William J. Woods, Harry Smith and others.

The Reading Hardware Co., Reading, Pa., has had plans prepared for the erection of a 1-story addition to its foundry, 80 x 260 feet.

A permit has been issued to the Federal Brass Co., 100 Champlain avenue, Cleveland, for the erection of a plant building, 60 x 139 feet.

The General Foundry Co., Ft. Worth, Tex., has been organized by B. N. Wadley, T. H. Stewart and others. It will establish a plant at 607 North Main street.

Capitalized at $50,000, the Okmulgee Foundry & Machine Co., Okmulgee, Okla., recently was incorporated by T. Frank Watson, F. C. Bockman and Clarence Jeffries.

Construction of a plant for the C. H. Turner Foundry Co., Inc., Statesville, N. C., has been started. The company was incorporated recently with a capital stock of $100,000.

Capitalized at $100,000, the Newport Furnace Corp., Newport, Ky., recently was incorporated with $25,000 capital stock by John R. Roman, V. D. Roman and A. A. McLaughlin.

The pattern shop at the plant of the Washington Iron Works, 318-22 East Lamar street, Sherman, Tex., recently was damaged by fire. J. M. Totten is president of the company.

Work is almost completed on the erection of a small building for the Brazil Machine & Foundry Co., Brazil, Ind. However, the company has not yet fully determined what its equipment requirements will be.

The foundry building formerly occupied by the Adrian Brass & Aluminum Co., Adrian, Mich., has been purchased by Fred A. Kaiser, Detroit, who will utilize the plant as a distributing agent.

The Inland Malleable Iron & Steel Co., plant at Terre Haute, Ind., recently purchased by T. J. W. McCausey of Detroit, representing a Detroit syndicate, will be improved. The new owners plan to spend from $25,000 to $50,000 on additions and betterments.

The Grimsby Foundry Co., Ltd., Grimsby, Ont., has been incorporated with $40,000 capital stock to carry on a general foundry business, by Thomas Worsley, Thomas Walker, Edward T. Adkin and others.

Work is expected to be started soon on the erection of the first unit of the Alloy Electric Steel Castings Co., Youngstown, O. It will be 118 x 280 feet and will have a capacity of 1000 tons a month.

Reuther Bros., Harrison, N. J., manufacturers of gray iron castings, have reorganized as the Reuther Foundry Co. and will expand their business to include cast iron pipe.

The Reeves Foundry Co. plant, Trenton, N. J., recently has been purchased for $77,000 at a sheriff's sale, by George L. Atkins, Langborne, Pa., who will organize a company to operate the works.

The Meier-Mee Foundry Co., Detroit, recently was incorporated with a capital stock of $15,000 to engage in a general foundry business. Incorporators include Edward L. Meier, 11 Hartford street and Gilbert H. Mee.

Enlargement of its plant by the erection of additions to its casting shop is planned by the Green Bay Foundry & Machine Works, Green Bay, Wis. It is estimated $50,000 will be expended on improvements to the plant. R. A. North is president of the company.

A lot 60 x 150 feet, adjoining its present works at 625-629 East Main street, has been purchased by the Wisconsin Foundry & Machine Co., Madison, Wis. It will be used as a site for a plant extension it is understood.

Recently incorporated with $50,000 capital stock, the Quincy Compressor & Pump Co., 217 Main street, Quincy, Ill., will manufacture vacuum pumps and air and water-cooled compressors. A completely equipped plant has been leased. Officers are: President, H. C. Yares; vice president, C. H. Irwin and secretary-treasurer, Mac Irwin.

Fire starting from an overheated stove in the Victor Stove Co.'s plant, Salem, O., damaged the stock and plant to the extent of $250,000. The plant will be rebuilt at once according to C. E. Sweeney, general manager. It was established more than 50 years ago and manufactures wood and coal stoves and ranges.

Capitalized at $50,000, the Kloeb-Cullum Stove & Furnace Co., Portsmouth, O., recently was incorporated by H. H. Mechline, C. A. K. Crabtree, W. J. Cullum, W. A. Riffle and Van M. Denton. The company is establishing a plant at 509 Front street, Portsmouth, O, for the manufacture of stoves, furnaces, etc.

Nonferrous castings will be manufactured by the J. B. Ripley Brass Foundry, Windsor, Vt., which recently was incorporated with a capital stock of $10,000. The company has taken over the business of J. B. Ripley, who is president of the new organization. A. M. Ripley is treasurer. E. L. Bishop also is interested in the company.

Capitalized at $25,000, the Lindgren Foundry Co., Mallory avenue and First street, Batavia, Ill., has been incorporated by R. E. Lindgren, C. E. Lindgren and C. H. Lindgren. It is understood the company will operate a jobbing foundry. Emil J. Benson, National Bank building, Decatur, Ill., represents the company.

The Victory Bearings Co., Indianapolis, has been bought by the McQuay-Norris Mfg. Co., St. Louis. Articles of incorporation show a capitalization of $150,000. The output of the plant will be enlarged. R. F. Crom, Indianapolis, will be manager and secretary. This company a year ago bought the property of the Wainwright Engineering Corp. of Connersville and H. A. Wainwright, general manager of that plant is one of the incorporators of the reorganized Indianapolis company.

Stockholders of the Muncie Malleable Foundry Co., Muncie, Ind., at their recent annual meeting re-elected these officers: President, J. N. Klock; vice president, Albert Sleeper; secretary, F. L. Bradford; treasurer, John Udell. Although the plant is located in Muncie, Ind., one-half the capital stock is owned by residents of Benton Harbor, Mich., and one-quarter by Muncie residents.

Operations are being started by the Universal Brass Works of Indiana, 130 South East street, Indianapolis, a new industry. Most of the machinery is in position. The company will manufacture turret nozzles for fire fighting equipment; hydraulic mining equipment and other products. C. H. Meyer is president; Mrs. L. A. Meyer, vice president and E. S. Harter, secretary-treasurer.

F. P. Parish, Chicago, has purchased the foundry owned by the Holland Engine Co., Holland, Mich., and will operate the plant. The foundry was erected about four years ago but has been idle for the past three largely because of a change in the type of engines manufactured by the Holland company. The building, which is 60 x 85 feet, will be enlarged it is understood.

Stump pullers, cotton pickers, and lifting devices will be the products of the Samson Power Machine Co., Inc., 3300 Dill avenue, Richmond, Va., which recently was incorporated with a capital stock of $50,000. The company plans to erect a plant including a malleable foundry. Officers are: President, Irvin Bain; vice president, James D. Sheehan and secretary and treasurer, J. S. Bain.

Stockholders of the Prentiss-Wabers Mfg. Co., Wisconsin Rapids, Mich., making stoves and other metal specialties for tourists, etc., at their annual meeting authorized expenditures of about $35,000 for new buildings and machinery. The additional capacity will be available about May 15 or June 1. D. B. Philleo is secretary and treasurer, and T. A. Taylor, vice president and general manager.

Erection of a foundry building during the current year is under consideration by the Athens Plow Co., Athens, Tenn. Needed equipment has not been figured on as yet. The company, which is capitalized at $100,000, until Feb. 1 was conducted as a partnership. Officers of the company are: President, R. J. Fisher; secretary-treasurer, E. L. Willson and vice president, C. L. Williams.

Plans have been announced for the organization of the Dalton Malleable Castings Co. at Warsaw, Ind. The company will have a capital stock of $350,000. J. Dalton of Warsaw will be president, and T. C. Frazer of the same city, will be secretary. The plant will be located in East Warsaw and it is expected operations will be started sometime in May.

New Trade Publications

OPTICAL METHODS—Optical methods in control and research laboratories are deal with in an essay published by Adam Hilger, Ltd., London, England. The methods dealt with in the booklet are those employing spectroscopes, spectrophotometers, refractometers and polarmeters. No detailed descriptions of these instruments or their techniques are given, but in each case references are given as to sources of information on these points. The booklet is divided into four sections, the first being devoted to metallurgical and analytical applications; the second to absorption spectra and spectrophotometry; the third to the refractometer and the fourth to the polarimeter.